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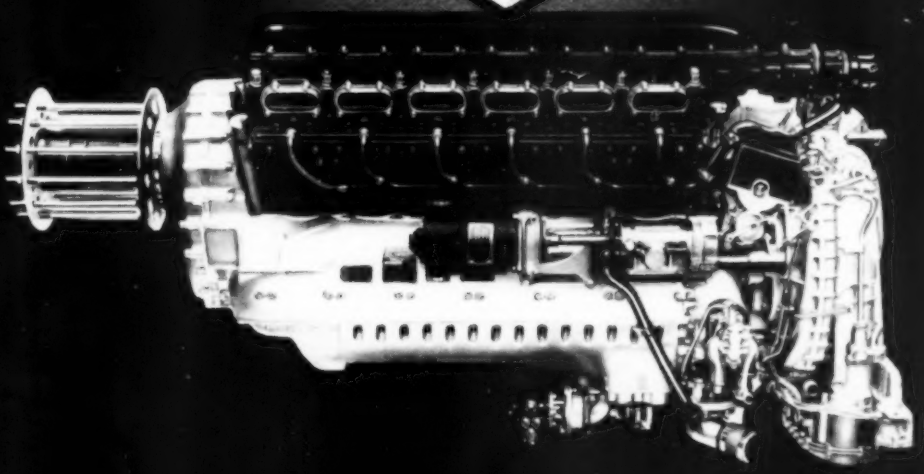

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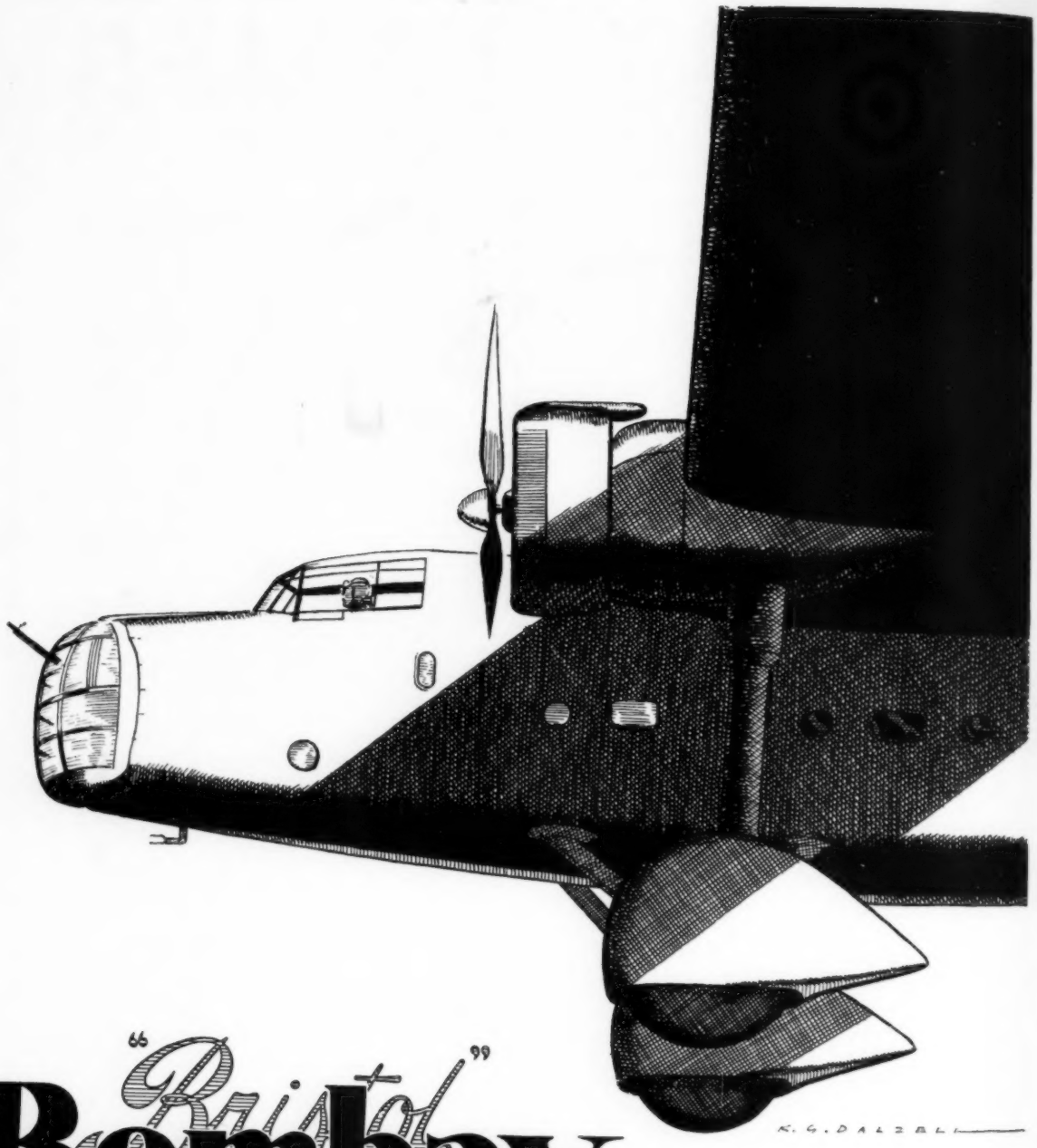

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The Outlook

The "Strike" Story

NORMALLY, the domestic affairs of the national air transport company are not our concern. If Imperial Airways care to dismiss or suspend eight of their pilots and to preach solemn warnings to a number of others, that is their own affair—and the affair of the Pilots' Association. No one outside can possibly form any fair judgment on the rights and the wrongs of the cases, each one of which is probably different from the others.

Nevertheless, a very great deal of nonsense has appeared in the Press and been talked in places where pilots forgather. The British Air Line Pilots' Association has been formed as a "protective" society, with certain plans (detailed on page 390) for the betterment of the transport pilot's conditions. There is not (and, as far as we are aware, never has been) any question of anything so drastic as strike action. The Association is merely carrying out its natural functions in approaching Imperial Airways for an explanation of the dismissals and for an understanding on matters pertaining to such things as flying pay and pensions.

Personally, we feel that a properly constituted association, conducted in a dignified manner, can do a great deal of good and no real harm to the business of air transport as a whole. It is usually more economical in the long run for any firm to employ a contented staff and one which knows that there is a suitable channel through which it can air its little discontents. In the very specialised case of air transport only the pilots themselves really understand the difficulties of their work; they, and they alone, can supply suggestions for the removal of these difficulties. Whether the company views the activities of the Pilots' Association with official displeasure is another matter.

Licence Grading

ON a number of occasions *Flight* has commented on the need for variations on the "B" licence theme and on the need for greater efficiency among radio operators. Modern air transport conditions demand a good deal from a pilot, and the fact that the standard of the present "B" is too low is amply proved by the way in which additional qualifications are almost universally demanded from applicants. There should, of course, be two or even three "B" licence categories for different purposes.

The problem of the grading of radio operators is a more difficult one. Transport pilots may obtain the necessary additional experience when flying as First Officers, but very rarely is it possible to carry first and second radio operators. Yet in no other way is it possible for newcomers to gain the necessary working experience.

In the meantime, W/T licences might be graded and some method evolved whereby less-experienced men are only permitted to carry out their work on "easy" services, on days when the presence of an operator is not essential for safety, or when acting as assistant operator to another with the necessary experience.

Nowadays there is quite a large nucleus of really experienced men, and their assistance and advice might reasonably be obtained in drafting out a new grading scheme. If sufficient encouragement is given we may eventually find that the first-class operator can quite easily act also as a fully qualified navigator in smaller machines.

Power at Milan

LAST week *Flight* was able to publish a detailed and critical review of the aircraft exhibits at the important Aero Show now in progress in Milan. This week we deal with the engines at the Show. These, as well be gathered from the outline appearing in this issue, include samples of nearly every modern variety, one notable exception being the high-revving, small-capacity, multi-bank in-line unit as typified by our Napier Dagger.

Two-row radials, with ratings in the 700-1,500 h.p. field, are much in evidence, but all these suffer, to a certain extent, from the inevitable complication attendant on the use of poppet valves. The severe simplicity of the Hercules, with its sleeve valves, would make quite a striking and significant contrast with the majority of comparable units on show.

Layouts which so far have not appeared in this country include the small-diameter and extremely compact two-row engine as exemplified by the Gnôme Rhône M.14 and the small Hispano and the inverted vee-eight which has gained quite a hold in Germany. The "double" Fiat racing engine is still unique.

TRAINING CRUISE : Some camera impressions by one who took part in the recent training cruise of No. 204 (G.R.) Squadron to Malta. Left to right: *H.M.S. Glorious* with attendant destroyer from 3,000 ft; the navigator of one of the four Londons—P/O. Hyde—at work; two of the boats, returning to England; and refuelling at Gibraltar from 50 gall. drums by means of the boat's auxiliary engine. Note the extra long-range tank.

Germany seems to be laying great store by her liquid-cooled inverted vees (Junkers and Mercedes), although the view obtainable from the cockpit of fighters powered with these units does not seem to have been enhanced as much as might have been expected.

Despite all the latest Continental advances displayed, our own designers will need to lose no sleep in keeping abreast and, in several categories, ahead.

Pirate Scotching

THE destroyer H.M.S. *Basilisk* was not attacked by a submarine after all. The frankness with which the Admiralty has admitted this is very welcome, and also it is most judicious. It confirms that since the anti-piracy patrol was instituted the piratical attacks on shipping in the Mediterranean have ceased entirely as though by the waving of a magician's wand.

In this good work the destroyers, British, French and, no doubt, Italian, have certainly been working in close co-operation with the flying boats. It is public knowledge that Nos. 209 and 210 (G.R.) Squadrons have flown from Britain to the Mediterranean, but there are probably other units as well. Only the other day it was announced that Sqdn. Ldr. McFarlane was slightly injured in a flying boat crash at Malta. He is the officer commanding No. 240 (G.R.) Squadron from Calshot, which is one of the recently formed units. The loss of the flying boat is an unwelcome mishap, but the mention of the officer's name is suggestive. Of course, there must also be numbers of French and Italian flying boats at work.

There is nothing that submarine commanders fear so much as the eye in the air. Some naval authorities say that one can see as far from the look-out on a ship's mast as one can from an aircraft. However that may be, when a periscope is sighted a flying boat can reach the spot more quickly than a destroyer can, and in the clear water of the Mediterranean the air observer can see a submarine some considerable distance below the surface.

In India

A CHANGE in the command of the R.A.F. in India is always a matter of interest. Air Marshal Joubert de la Ferté, who has lately held the Command-in-Chief of the Coastal Command, has now gone to Delhi as A.O.C., R.A.F., India. There is a big difference between being an A.O.C.-in-C. and a mere A.O.C. In India the C.-in-C. is very much the C.-in-C., and he is the head of the Army in India, and he is the only man responsible for the defence of the frontiers. He really ranks next to the Viceroy in importance, and, apart from the Viceroy and the provincial Governors, he is the only man whose name is prefixed with the magic letters "H.E." These initials do not stand for High Explosive, but for His Excellency.

Consequently, the position of the A.O.C. is delicate and calls for tact. The Army in India, speaking by and large, looks on the Air Force as a provider of reconnaissance and of long-range guns, both of which are a great help to the troops. Occasionally it deputises for the Supply and Transport Department of the Army. The Air Force, again speaking by and large, is under the belief that if only the Army would clear out and leave it—the R.A.F.—to settle the Frontier question, it would deal with the Pathan tribesmen as quickly and painlessly as it suppresses all lawless tendencies in Iraq and the Aden hinterland. Sweet reasonableness is needed on the part of both C.-in-C. and A.O.C. if H.E. is not to take on its alternate meaning.

But if the new A.O.C. in India no longer commands all the general reconnaissance and torpedo bomber squadrons "in Chief," at least he is far away from the Air Council, and in his own Service is supreme in all the vast Indian Empire. Judging from *Flight's* personal contacts with Air Marshal Joubert de la Ferté, we feel confident that he will be a great success in his new post. But we should very much like to know what the average Bengali Babu will make of his name.

Australian Defence

THE coming elections in Australia are to be fought partially on a question of defence. The Government of Mr. Lyons is for increasing all three fighting Services, but holds generally that the Navy and Army are the main stand-by, while the Air Force should act as an ancillary to both. This policy, he claims, means working in with the forces of Great Britain, which Australians call Imperial Forces. The Opposition takes the view that Australia can never hope to have a Navy big enough to defend her enormous coastline, but that the Royal Australian Air Force,

if sufficiently expanded, could make a hostile invasion impossible, and, therefore, should receive all the help which the Government can give, while money spent on a Navy is waste. This policy is called by the Government spokesmen "isolationist," on the ground that Australia would never be able to help the Imperial Army or Navy, and would hardly look to them for help in defeating an invasion.

Flight is naturally neutral so far as politics are concerned, but in this case it appears that the plan of the Opposition is on the sounder basis. It is manifest that no Navy which Australia could ever afford would be much protection by itself, and it could only be useful when working in conjunction with the Imperial fleet based on Singapore. An Air Force, on the other hand, might well be able to make invasion impossible, though it could not prevent a blockade of the Australian coast. In any case, only the Imperial Navy could do that. Any invaders must obviously come from over the sea, and must have a long line of communications. Transports are particularly vulnerable ships, and few would deny that a landing is an impossibility in the face of a vigorous Air Force. The mobility of an Air Force enables it to defend a much greater length of coast than any ships or troops could do.

Nor can we see that Australian reliance on air defence can justly be called isolationist. In war Britain must go heart and soul to the help of any threatened Dominion, and we want no Achilles' heels in the Empire. If the Royal Australian Air Force can ensure the safety of the Australian coast line, that lightens by so much the responsibility which Britain has to shoulder. Of course, any contribution which the Commonwealth can make to the naval strength of the Empire will always be welcome. It was H.M.A.S. *Sydney* which scotched the *Emden*. Likewise, the deeds of Australian soldiers are not forgotten. But geography dictates that in the defence of Australia the air should take pride of place.

The Revivalists

HISTORY certainly does repeat itself. Some of the early aeroplanes had wheels in front and wheels behind; Mr. Cody, of unforgettable memory, even put wheels on his wing tips, and one German pioneer beat them all by putting wheels above his wings so that the machine could land just as well upside down!

That was in the days when we were mainly concerned with getting aeroplanes into the air and did not worry overmuch about drag. But as soon as aero engines got to the point of running for half an hour or so without packing up, we began to realise that the aeroplane was everlastingly climbing up a hill of one in five or so, and that if we could, by suppressing drag-producing members, increase the ratio of lift-drag to 10: 1, the machine would be climbing a hill only half as steep.

With that realisation came the "axe." Every strut and wire that was not absolutely essential was removed. That this operation was not altogether superfluous will be realised when we recall that one of the early Dunne tailless machines was said to have twenty-seven struts in its undercarriage (we cannot guarantee the figure, as we never had the the time to count them); and who of the old-timers does not remember the so-called canary test?

Gradually the skids disappeared, the wires were reduced in number, and the orthodox type of aeroplane became the tractor biplane, with one or two bays according to span, and with vee undercarriage struts and cross axle.

Retractable Tricycles

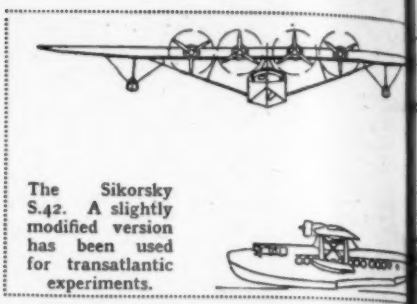
THE next step was the retractable undercarriage. Speeds had gone up to the point where to tolerate an undercarriage drag of perhaps one-sixth of the total was not to be thought of. The result we see all round us at the present time: the low-wing cantilever monoplane with two or four engines and the wheels retracting into the engine nacelles. But the two-wheel undercarriage brought with it certain disadvantages; these had almost come to be accepted as inevitable until a few bright lads remembered that there was something to be said for the undercarriages of the early aeroplanes. By burying them the extra drag does not matter, and so we are now threatened with a spate of retractable tricycles.

How great importance is attached to this subject is illustrated by the fact that one British firm has stated that it considers the abandonment of the low-wing type justified in order to provide a neater retracting three-wheeled undercarriage in a high-wing layout.

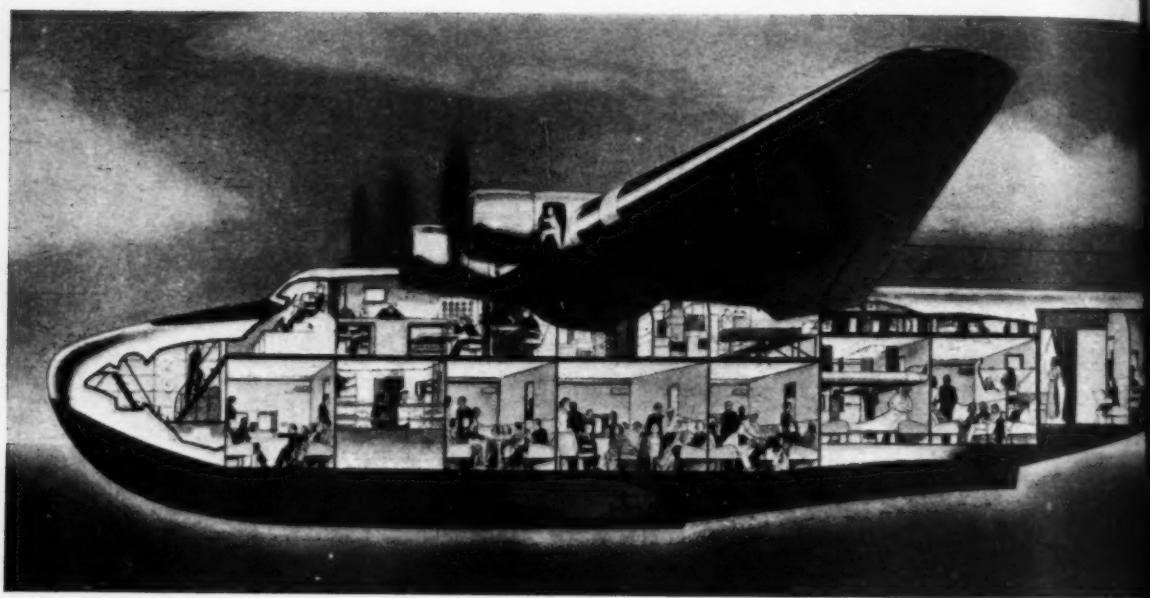
DIARY OF FORTHCOMING EVENTS—PAGE 392

ATLANTIC ASPIRANTS

Ocean Aircraft of Five Nations : Contrasting Approaches to a Common Problem



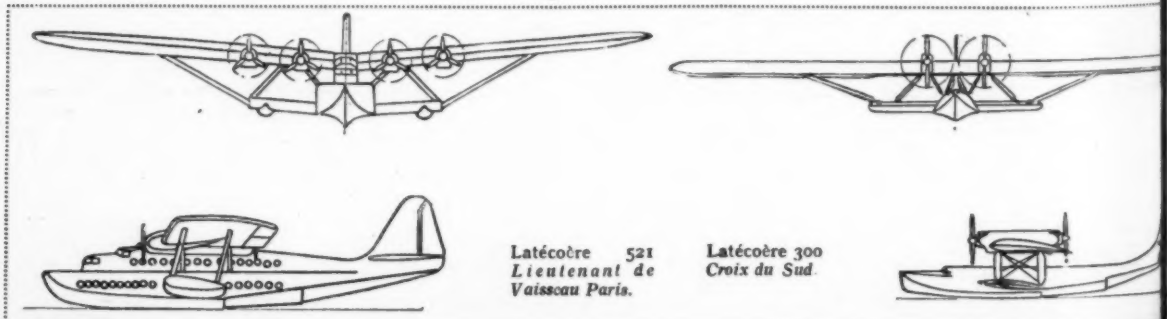
The Sikorsky S.42. A slightly modified version has been used for transatlantic experiments.



APPARENTLY the rivalry among transatlantic operating companies and the designers of their equipment will become so intense that commercial aviation will receive a fillip comparable with that which resulted in such great technical progress during the war. Already at least four distinct approaches are being made to the problems associated with the regular carriage of passengers, mails and freight to North America ; there are multi-engined flying-boats adapted from standard commercial models, floatplanes for catapult launching, high-speed landplanes, and the Mayo-composite effort. Flying boats and landplanes are likely to evolve along their peculiar lines, but it may be found that the catapulting of floatplanes and aerial "pick-a-back" launching are but stepping stones to more practical methods of assisting take off, for of all the problems which beset designers of long-range commercial machines the take-off question looms blackest.

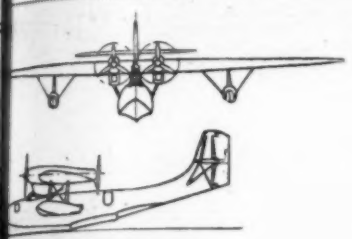
The success of *Cambria* and *Caledonia*, the special long-range Empire-type flying boats of Imperial Airways, and the Pan American Sikorsky Clipper in preliminary North Atlantic flights is already flying history. These flights, have provided data for the introduction for similar duties of boats of about double the weight as typified by the so-called "Double-Empire" machines now in the early stages of construction at Rochester and the Boeing 314 Super-Clipper well advanced at Seattle.

There is a certain affinity between the Short and Boeing efforts. So far as is known, the Short will be powered with four Bristol Hercules two-row sleeve-valve radials which represent the latest air-cooled practice in the 1,300-1,500 h.p. category, while the Boeing has been designed to take the new Wright two-row Cyclone which, operating on 100-octane fuel, should give a similar output. Details of the Short are being withheld, but the Boeing concern, anxious to publicise its decision to concentrate on four-engined machines exclusively, has issued a certain amount of information on the Model 314.

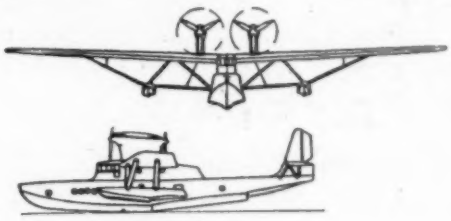


Latécoère 521 *Lieutenant de Vaisseau Paris.*

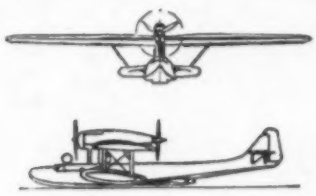
Latécoère 300 *Croix du Sud.*



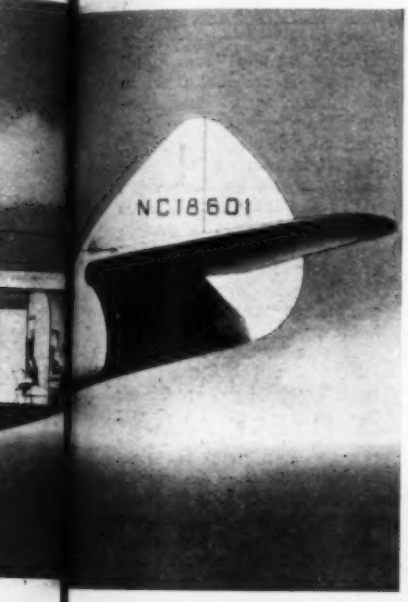
Lioré et Olivier H.47.



Loire 102.



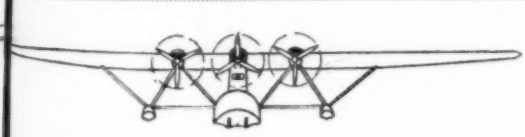
Dornier Do.18.

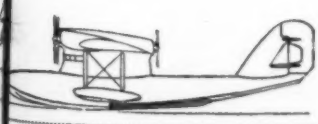


The miniature outline drawings on these pages illustrate various types of machines which have been used over the North or South Atlantic. They are to a uniform scale and are reproduced from a paper, "North Atlantic Air Service," read by Mr. J. H. Parkin, M.E., M.E.I.C., F.R.S.C., F.R.Ae.S., before the Engineering Institute of Canada.

Six 314s are on the stocks, though all of these are not destined for transatlantic service. Flying at a gross weight of 82,000 lb. (possibly increased for transoceanic work), the 314 will carry the equivalent of seventy-two passengers, a crew of eight, and what is described as an unprecedented amount of cargo. There will be two decks for passengers (in the Empire boats the upper section of the hull is reserved solely for the crew and mails), and characteristic features will be the advanced form of "seawings," or sponsons, and the sharply tapered cantilever wing which is carried on the upper portion of the hull proper, Short fashion, and not on a streamlined superstructure as on the Martin and Sikorsky types which the Boeing 314 will supersede.

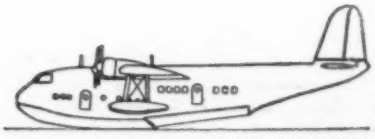
On the left is a sectioned view of the Boeing 314 Super Clipper of the type which, with auxiliary tankage, is likely to be used some time next year for transatlantic experiments. The engines are four Wright two-row Cyclones of about 1,500 h.p. each. Below is an impression of the Boeing 307 landplane. At least one of these machines, now being built at Seattle, is likely to be used by P.A.A. for transatlantic work. It will have a pressure cabin for sub-stratosphere flying.

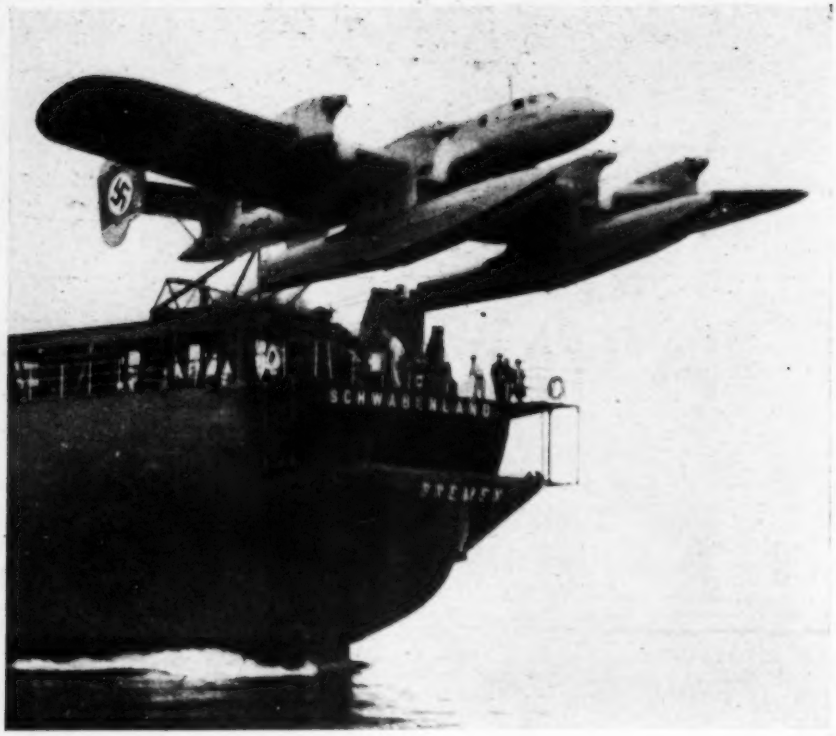




Blériot 5190
Santos Dumont.

Short Empire Class
(long-range version
almost identical).





***Nordmeer*, one of the two Blohm and Voss Hamburger floatplanes with four Junkers Jumo diesel engines, built specially for trans-atlantic work. The machine is seen leaving the Heinkel catapult of one of Luft-hansa's "floating bases."**

The nacelles are so designed that the double-row Cyclones may be reached in flight, although the benefits to be derived from such an arrangement are problematical.

A particularly striking feature of the new Boeing is the massive single fin and rudder assembly revealed in preliminary drawings. This is particularly interesting in view of the recent trend toward duplication (and even, in the case of the big Douglas D.C.4, triplication) of the vertical tail surfaces. Meanwhile, Martin is abandoning the single fin and rudder which characterises his 130 model in favour of the double arrangement. This is being incorporated on the four-Cyclone boat for Russia.

The estimated maximum speed of the new Boeing is about 200 m.p.h. so, with the aid of the Hamilton constant-speed airscrews which are specified, a cruising speed of 165-170 m.p.h. should be practical.

Technicians are awaiting with particular interest the results of preliminary tests as affecting the "seawings." It may be recalled that, on the Martin 130 Clipper, these stabilising projections were claimed to give about half the lift of wings of the same area. From the operator's viewpoint they are desirable because they provide a walk-way for passengers boarding and disembarking. And into the bargain wing-tip floats sometimes have an awkward habit of coming off.

It was reported, incidentally, that the accident to the prototype Licré et Clivier H.47, Air France's very fast four-Hispano boat, was the result of a wing-tip float breaking adrift. This machine was of refined design and was powered with four Hispano-Suiza Y engines of 860 h.p. each in two tandem pairs. A maximum speed of 223 m.p.h. was claimed, but the range was less than 2,500 miles. A provisional order for five more of these machines was placed before the accident to the prototype.

Bretagne, Air France's Loire 102, seems to have been a little disappointing during trials. Originally designed for South Atlantic work with a range of 2,600-odd miles while carrying four passengers and 1,430 lb. of mail, the Loire has a stated maximum speed of 192 m.p.h. which, in spite of the fact that it weighs much less than a long-range Empire boat (37,800 lb., as compared with 45,000 lb.), seems an optimistic estimate considering its angular and bestrutted

The Lioré et Olivier H.47 flying boat which, had it not crashed during trials, would have been used by Air France Transatlantique for experimental crossings. With four 860 h.p. Hispano-Suiza Series Y engines, this machine was said to be very fast indeed.

Bretagne, the French Loire 102, is claimed to have a top speed of 192 m.p.h. with four 720 h.p. Hispano-Suiza Series X engines. The appearance of the machine would suggest something considerably lower.

form. There has been a good deal of modification.

Recent reports have it that the imposing six-Hispano Latécoére *Lieutenant de Vaisseau Paris* will not be used for North Atlantic work due to insufficiency of range. The cruising speed is also comparatively poor.

Of similar weight to the massive *Lieutenant* (37 tons approx.), the C.A.M.S. 161, which should fly next year and be in experimental service by the summer of 1939, has some impressive "paper" figures. With a ceiling of over 16,000ft., a range of 3,700 miles against a 37 m.p.h. wind and a cruising speed of 185 m.p.h., it may do much toward enhancing France's position in the field of flying-boat construction.

Built to meet similar requirements (to fly with a commercial load from Paris to New York in less than twenty-five hours in face of the strongest winds), the Lioré LeO. H.49, which, likewise, will have six 1,500 h.p. engines in line abreast, should also be flying next year.

The hybrid landplane-with-emergency-planing-bottom as advocated by Blériot and Piaggio (the latter concern has been experimenting with a very large "semi-high wing" monoplane of Double Eagle layout with four liquid-cooled engines) is not meeting with approbation. The general feeling seems to be that the hydrodynamic qualities can be obtained only at the expense of a good deal of aerodynamic efficiency and that it is better to build a flying boat pure and simple.

Germany deserves a good deal of credit for her efforts with "catapultable" twin-float seaplanes (Blohm and Voss) and flying boats (Dornier). It is commonly felt that the large float-plane has no future because of its comparatively small reserve of buoyancy and poor seaworthiness. The excellent results obtained with the Italian Cant Z.506 series and the efficiency demonstrated by the *Nordwind* and *Nordmeer* may indicate that, though the days of the floatplane may be numbered, it is capable of a good deal of useful service in certain directions.

The Dornier Do.18 twin-diesel flying boat (top speed 155 m.p.h., cruising range 2,765 miles) is quite well known, but the Blohm and Voss Hamburger twins are comparatively new. These striking "cranked-wing" floatplanes are claimed to be able to fly with full load on three alternative engines or, with reduced load, on any two. Characteristics are: Useful load, seven tons; range, 3,107 miles; maximum speed, 186 m.p.h.; cruising speed, 155 m.p.h.

The various transatlantic landplanes under construction and on test exhibit a number of important structural and aerodynamic advances. Our own Albatross, for example,

Mercury, the upper component of the Short-Mayo effort, during trials on the Medway. This is a comparatively small machine of less than 1,200 h.p.

employs bakelite and balsa wood quite extensively, and its four Gipsy Twelve supercharged inverted-vee engines are cooled by a new system whereby air is taken *forward* round the engines.

Heinkel's new effort—the He.116, described in *Flight* of September 2nd—is worthy of note, particularly as it uses four low-powered inverted-vee engines. Its speed is a good deal lower than that of the Albatross, which will probably cruise at about 210 m.p.h.

France is pursuing the landplane line with considerable vigour. There are reports that the Air-Couzinet 10, which was just too late to participate in the Damascus race, is in the running as an experimental transatlantic machine. This machine is of wooden construction (simplifying the flotation problem) and mounts two 660 h.p. Hispano 9Vs, which are direct-drive Wright Cyclones built under licence. The all-up weight, according to the latest figures, is 18,500 lb. and the maximum speed (estimated) 260 m.p.h. A range of 4,800 miles is claimed and the pay-load is 550 lb. Couzinet also has a three-engined type on the stocks. With Hispano Cyclones this model is calculated to do 280 m.p.h., but the range, against a wind of 37 m.p.h., will be only 2,500 miles. The payload is about twice that of the Model 10.

Another potential Atlantic contender is the 295-m.p.h. twin-Hispano Amiot 370, also a scratched Damascus race entry.

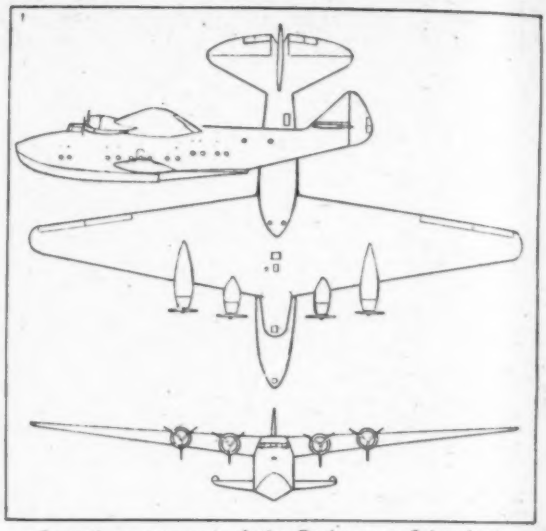
There seems to be a good deal of uncertainty as to the ultimate destination of the Couzinets and the Amiot, but Farman is going ahead with some machines which, in view of the experience obtained with the *Centaure* and *Ville de Montevideo* over the South Atlantic, seem to have a good chance of seeing some serious service.

New Farman Landplanes

The types concerned are the 2220, 2230 and 2231. Model 2220 is really an improved *Centaure* and has four medium-supercharged Hispano X engines which give it a cruising speed of about 140 m.p.h. and a range, against a 30 m.p.h. wind, of 3,100 miles. The 2230 has tapered wings of reduced area and should cruise at 160 m.p.h., the range being about 600 miles better than for the 2220. The third Farman type is similar to the 2230, but is fitted with four of the new Hispano-Suiza 14Ha two-row radials of over 1,000 h.p. in place of the Series X Hispanos, which give a little more than 700 h.p. It is said that the fuselage has been designed to permit alightings on the sea and to offer a good measure of flotation.

Ever-faithful to landplanes, K.L.M. is reported to be speculating in a three-engine monoplane being built by the "de Schelde" concern. Wright Cyclone Gs are specified, and the maximum speed is estimated at 257 m.p.h., the cruising speed on 55 per cent. power being 208 m.p.h., and the range against a 37 m.p.h. wind, with 3,500 lb. of payload, 3,100 miles.

Rumour has it that a special tri-motor Savoia is being prepared in Italy for transoceanic flying. This may be a version of the 267 m.p.h. S.83, now on show in the Milan Salon.



General arrangement of the Boeing 314 flying boat.

The Short-Mayo composite experiment has now reached the stage where *Mercury*, the comparatively small Rapier-engined floatplane, has been mounted upon the broad back of *Maia*, the specially built lower component and the combined "eight-engined biplane" has been launched preparatory to the great division. If this very courageous effort meets with the success it deserves we may look forward to some really outstanding performances from more advanced upper components, possibly landplanes with a retractable undercarriage, or, maybe, just a landing skid, taking full advantage of the benefits offered by this ingenious scheme.

Things to Come

And so experiments will go on. All possible solutions to transatlantic problems will be examined and their value assessed, if need be, by expensive practical tests. Meanwhile, reports and rumours concerning the latest international efforts come in thick and fast. Even as we go to press a few details of a proposed Glenn Martin effort have arrived. A high-wing, four-engined monoplane, with wing-tip floats, twin rudders and a peculiar bulbous bow, this 55-ton craft will accommodate sixty-four passengers and may be equipped for operation at about 25,000ft., presumably being provided with a "pressure" cabin of the type which Martin is known to be developing.

Farman is developing some high-performance landplanes from the *Centaure* type (above) which is being used on the South American service.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

THE GREAT EXPERIMENT : This week *Maia* and *Mercury*, the two components of the Short composite aircraft, were brought together on the water for the first time. In this *Flight* photograph, taken last Tuesday, *Mercury* looks oddly small, although she is of 73ft. span and 21,000 lb. gross weight.

A CAPRONI III has been equipped as a "flying laboratory" for psychological study. Reports of experiments were given at the recent convention in Milan of specialists in the medical and psychological aspects of flying.

The Australian Government has purchased, for a substantial lump sum payment, the rights for the Handley Page slotted wing.

Two of the first new R.A.F. Volunteer Reserve Schools opened at Gatwick and Gravesend last Friday. Six Tiger Moths and six Hart Trainers so far form the equipment of each school.

The chief flying instructor at Gatwick is Flt. Lt. A. D. Bennett, and at Gravesend Flt. Lt. J. B. Tatnell. At the moment, with the help of their assistant instructors, they are dealing with twelve and fourteen pupils respectively.

Captain V. K. Kokkinaki, the Soviet test pilot, is now the holder of six international records. His latest "bag" is a non-stop flight of 3,125 miles at an average speed of 203 m.p.h.

The Fieseler Storch monoplane which, with the help of specially designed flaps and slots, has some Autogiro-like characteristics, has been used at the German Army manœuvres for liaison duties. A landing run of 25 yards is needed and take-off requires about 50 yards. The speed range is given as 24-130 m.p.h.

A Farman 239 monoplane with a Pobjoy engine has broken the world's speed record for Class "C," third category (speed over 100 km. for two-seaters). The pilot was Pierre Berthomier and the speed 186.993 km./hr. The record has been homologated by the F.A.I.

Twenty-five Years Ago

(From "Flight," October 12, 1912.)

"The twin-engine system has recently been installed on a monoplane built by Messrs. Short Bros., and during tests made by Commander Samson at Eastchurch, the machine, which has two 70 h.p. Gnome engines, performed very satisfactorily."

According to a Japanese correspondent, the aircraft chiefly employed in the bombing of China is the Mitsubishi 96 attack bomber (two 1,000 h.p. Kinsei engines). Known as the "Japanese Blenheim," it is claimed to be capable of more than 400 km./hr.

They have proved too fast for the Chinese defenders, among which (according to the same source) are Curtiss Goshawk and Northrop machines. Most of the raids were made at low altitude.

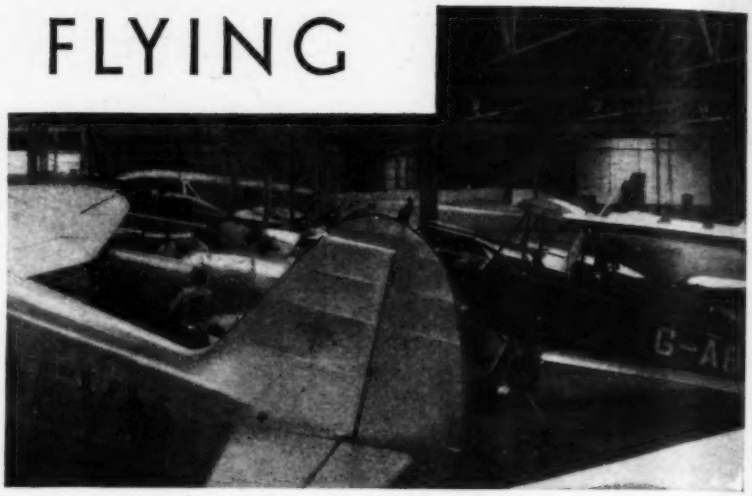
Rear-Admiral Cook, of the U.S. Navy, recently announced that the present naval aviation policy calls for 2,000 machines by 1941. When the programme is complete there will be 68 squadrons, of which 39 will be ship-borne.

"Flown covers," together with models of ancient and modern mail-carrying aircraft of Imperial Airways and Air France, will be shown in the "Postal History" section of the London Stamp Exhibition, which takes place at Dorland Hall, Lower Regent Street, from October 16-23.

The Royal Aero Club has been informed by the Aero Club de France that, as the race for the Coupe Deutsch de la Meurthe, 1937, did not take place, the prize money, amounting to 100,000 fr., will be added to the prize money offered for this year's race, making the total 200,000 fr. Entries at single fee close on October 20.

Using a Seversky Executive monoplane with Pratt and Whitney Twin Wasp engine, Miss Jacqueline Cochrane has established a women's international speed record by averaging 293.05 m.p.h. on four consecutive runs over a three-kilometre course. Her fastest run was 304.6 m.p.h. The record was previously held by Helene Boucher with 276.53 m.p.h.

PRIVATE FLYING



THE ILL WIND : A corner of Rollason's hangar at Croydon. In the foreground is a Stinson Reliant, with the little Latvian V.E.F. J.12 behind it and the South African Junkers Junior on the right. One of I.A.F.'s Curtiss Condor freighters can be seen in the far distance. (*Flight* photograph.)

Topics of the Day

Not Only Flying

I HAVE occasionally remarked that the average club pilot knows very little about the machines which he flies. He has very little chance of learning.

The little I know about checking, starting, warming and running-up an engine, about folding and unfolding wings, and about adjusting control cables has been learnt from time to time in the hard school of necessity. Rather than admit my fearful ignorance in the past, I have simply set about the business myself and found out how to flood a carburettor (balancing the loose cowling on my head while necessarily using both hands), where to attach the jury struts and so forth. All of which was probably very illegal, but, once having been learnt by such methods, the various procedures are never forgotten.

The whole matter has cropped up again after a glance at the rules of a competition run by the Yorkshire Club. In this, marks are not only allotted for the usual flying and navigation tests, including a spot landing, but also for the pilot's ability in preparing a machine for flight. He must get the machine out of the hangar, unfold its wings, check the fuel, oil and controls, start the engine, and taxi out. A fifth of the maximum number of marks obtainable in the competition are apportioned for these various little matters, which presumably include an unmentioned, but highly necessary, run-up In fact, the maximum "preparation" score is the same as that given for the navigation test.

Encouraging the Outsider

"CLIQUE-ISM" is an inevitable feature of all club life, and the more patient (or less egotistical) newcomer usually finds that these so-called cliques are not nearly so hidebound and cast-iron as they at first appear when he marches into the club for the first time.

A few weeks ago I met someone who had joined a well-known flying club and had never been near it again after his first two visits because, apparently, "nobody took any notice of him." Why should they? It was up to him to show himself sufficiently interesting to merit their notice. Apparently, too, the instructor was terse in the air, and did not, afterwards, immediately ask him to "come and have a drink." Probably he had some more flying to do, and, in any case, if he asked every one of his pupils to have a drink with him it would be necessary to take him to a hospital with alcoholic poisoning. As it happened, this instructor was, to my knowledge, in fairly serious training at the time, and it must be distinctly dull to drink a grape-fruit while talking to a boring young man with a pronounced inferiority complex.

The many shy newcomers to the business of amateur flying might well comfort themselves with the thought that nobody is deliberately ignoring them and that they will be noticed in due course.

Nevertheless, clubs whose membership is tending to decline might well do their best to make such people feel comfortable—provided that the hospitality business isn't overdone. There is nothing I hate much more than being approached by a sort of good-fellowship salesman who introduces me to three dozen complete strangers (whose names are never heard, least of all remembered) just when my sole ambition is to be left alone with my sorrows. There is such a thing as an over-friendly manner which deceives nobody; the owner of such a manner often spoils the effect by looking right through you at the next meeting—sometimes to one's immediate and immeasurable relief.

In the Open Again

AT irregular intervals the desire to fly an open machine which is very much in the aerobatic category comes over all of us. In fact, the more one flies in cabin machines, however excellent and comfortable, the more does one enjoy the occasional crack round in something Tigerish. Yet when we were forced by necessity to make the best of such machines we grumbled ceaselessly and envied the members of a nearby club which had grandly invested in a Puss Moth or a Desoutter for the use of more advanced members—and these were comparatively few in those days.

Last week-end, after appreciating the more immediate pleasures of flying an open machine under a blue sky and over a cloud layer, I bethought me again of the old down-wind turn controversy, and decided to settle it there and then. The upper-wind speed was probably 15-20 m.p.h., and I found that the machine stalled in a near-vertical turn at an air-speed of 60 m.p.h.

With this fact in mind I proceeded to do a long series of really steep climbing turns on full throttle. I found that with the controls kept rigidly in one position it was possible to hold an entirely accurate turn while watching the nose and the A.S.I. in a turn. The former remained in exactly the same position throughout four eight-second rotations while the A.S.I. read 70 m.p.h. with great consistency. According to the theorists, either the air speed or the attitude should have been changing all the time, since I was "decelerating" from 90 m.p.h. to 50 m.p.h. (10 m.p.h. below the stalling speed) and "accelerating" again through the same range in eight seconds. Something like 1,500ft. was gained during the experiments, which at least provided me with some useful practice in making steep turns at a critical and constant speed. I'm sorry to bring that up again.

Afterwards I spun and spun until I felt rather sick and until I really could stop the rotation just where I wanted to. The trouble is that one must look over the centre-section, and that is nearly as unpleasant as looking over one's shoulder. I tried that once; never again. As old age creeps on I find myself climbing higher and higher before beginning the business of frightening myself with a few mild aerobatics. This time I did everything between 3,000 and 5,000ft. Presently I shall require a supercharged engine *and* a parachute.

INDICATOR.

FROM the CLUBS and SCHOOLS

RENFREW

THE Scottish Flying Club spent 113½ hours in the air during September. This was mainly obtained in solo flights. Miss I. N. Lamont secured her "A" licence.

EDINBURGH

Perfect weather was experienced throughout last week, and the club aircraft were fully employed. Mr. Craig made a first solo.

C.A.S.C.

Last Sunday members flew 7 hr. 45 min. at Cambridge, this figure including a certain amount of blind-flying instruction for candidates for the Cambridge Aero Pilot's Certificate.

MIDLAND

Cross-country flights were carried out to Desford, Walsall, Hatfield, and so on, and flying for the two weeks ended October 8 totalled 57 hours. Mr. D. H. Gittins made a commendable first solo.

LONDON

The flying time for last week totalled 62 hr. 40 min. Mr. L. A. Hordern made his first solo flight, and Mr. J. Keegan completed the tests for his "A" licence. New members were Messrs. F. Warbey and G. Buchanan.

BORDER

Cross-country flights were made to Newcastle, York and Perth, and the flying times for October have been extremely good, already equalling last year's total. First solo flights were made by Messrs. G. Carr and T. Henderson.

HULL

Messrs. B. Short and G. S. Smith made first solo flights, and, with Mr. Seivwright, completed their "A" licence tests. The 76 hours flying for September shows only a very slight reduction on the August figure.

NORTHAMPTON

An annual firework display and "Tramps' Party" will be given on November 5. First solos were made by Miss C. Maunsell and Mr. E. H. L. Cooper, and a total of 76 hours' flying was logged during the month of September.

YAPTON

Drizzle and high winds have seriously handicapped flying at Yapton, and only 26 hours were recorded last week. Cross-country flights were, however, made to Southend, Hatfield, and Lympne. Mr. L. A. Groom made his first solo.

PENANG

Owing to the chief instructor's absence in Singapore for several days during August, there was a considerable drop in the flying times, which amounted to 119 hours. Mr. and Mrs. Oke made successful first solos and Mr. Mortimer completed his Straits Settlements "A" licence tests.

CAMBRIDGE

Members taking "B" licences have undergone intensive advanced instruction in preparation for their Air Ministry tests, which they hope to take about the middle of this month. The Puss Moth was flown to Croydon and a Moth was taken to Bircham Newton for a day or two. Flying for the week ended October 10 amounted to 57 hours.

HANWORTH

The club fleet has now reached normal by the return of two machines from C. of A. overhaul, making a total of eight. Messrs. R. Pryce, K. Hill and J. Chubb have completed "A" licence tests, and Mr. F. Appi is concentrating on a blind-flying course. Mrs. Kirby-Green is taking a "B" licence course. Flying time totalled 63 hr. 15 min. last week.

REDHILL

Members have been busy flying abroad, and trips to Amsterdam, Dieppe and Paris were the principal attractions. A reduction of 10s. per hour for solo on Moths has been made as from October 1. An increase of fifteen new flying members was encouraging. Messrs. A. J. Mulder and I. Harvey obtained their "B" licences, and Messrs. Wise, Bailey and Swain made satisfactory first solos. Flying amounted to 171 hours.

HERTS AND ESSEX

During the week ended September 30 flying times totalled 65 hr. 51 min., making a total for the month of 355 hours. On the following week the total was 51 hr. 56 min. Messrs. J. M. Defferary, K. Blessing, E. Giansante, and D. A. Whiting made first solos. Mr. Dennis Cather, who has only just reached his majority, has obtained his "B" licence. The first of the winter dances will be held in the club house on Thursday, October 28.

NOTTINGHAM

The annual competition for the "Nemo" Cup was held on October 3, the winner being Mr. Ewart Wilson and Mr. G. Simkins runner-up. Further flying competitions are to be held shortly. A dance, the first of the season, takes place at the clubhouse on October 29. Nearly 20 hours' flying was recorded for the week ended October 7, and during September 107 hours were flown. Several new members were welcomed.

YORK AND LEEMING

The first club dance of the season, held at Betty's Café, York, proved a great attraction, and over 160 people were present. The Yorkshire Aviation Services expect shortly to have a Cadet available for the use of experienced pilots and to take the place of the Magister, which is convalescing at Reading. Cross-country flights to Leicester and Reading and taxi-trips to Haydock Park and Heston were part of the week's activities. Flying for September amounted to 167 hr. 5 min.

BROOKLANDS

Early morning fog has persisted throughout the week, and this accounted for the relatively low flying time. Sunday, October 3, was better, however, and the first heat of the landing competition for the "Hart" Trophy was flown. There were eleven entries, and the leaders at the end of the day were Messrs. Bishop and Symondson. The next heat will be next Sunday. An interesting visitor was His Highness Prince Abbas Halim, cousin of H.M. King Ferouk of Egypt, who has been gaining experience on Tiger Moths. Mrs. Storm made a first solo and Mrs. Duncan and Mr. Tony Hankey completed "A" licence tests. Flying time amounted to 48 hours.

LEICESTER

The Club's financial year ended on September 30, 1937, and the all-in flying time for the year amounted to 886 hr. 10 min. The first club dance of the season was held on September 17 and was attended by 120 members and friends. Intensive night flying took place on September 25, and a cross-country test was made to Castle Bromwich and back. Messrs. F. J. Toone and A. E. L. Boulter made first solos and Messrs. A. B. Crankshaw and M. B. Hanford were successful "A" licence candidates. Cross-country flights to nineteen aerodromes helped to increase the September flying times to 110 hr. 25 min.

YORKSHIRE

The annual ball will take place again on November 19 at the Hotel Majestic, Harrogate. Flying times for the week, including flights to Donington, Chorley and Blackpool, amounted to 50 hr. 10 min. The contest for the Grimthorpe Trophy is now in full swing. This competition is a really useful one, in which marks are obtained for the preparation of the machine (unfolding the wings and so forth) as well as for normal flying ability, forced landings and navigation. The trophy and the three other prizes given by Mr. Ives will be presented at the annual ball. Mr. W. Downs, incidentally, has also offered a cup for the member who shows the greatest improvement in his all-round flying ability between January 1 and October 31.

NEWCASTLE

Following the announcement of the Air Ministry's new subsidy scheme it has been decided to reduce flying charges from 28s. to 25s. an hour, a very welcome step, appreciation of which is reflected in the fact that a total of more than 40 hours was logged during the week. On Sunday the officers of H.M.S. *Newcastle* were the guests of the Club, and fortunately it proved to be one of those rare occasions at this time of the year when the weather was really good. The visitors were welcomed by Sir Joseph Reed (President) and Captain J. D. Irving (Chairman), and, after being taken for joy-rides, were entertained in the Club. Mr. Chipman, the steward, excelled himself, and the array of edibles and—perhaps more important—the temporary bars brought well-merited praise. The Navy certainly discovered that they had formidable rivals in the art of hospitality.

A.S.T.'s September

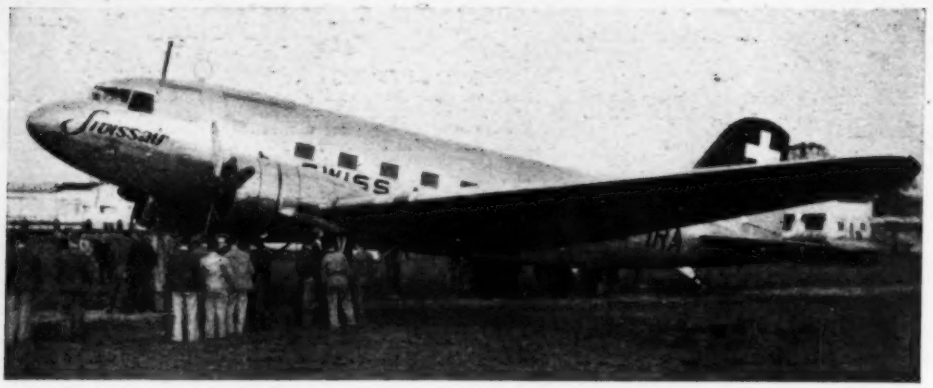
LAST month was one of considerable interest at Hamble. In the first place the Sopwith efficiency cup, presented to Air Service Training by Mr. T. O. M. Sopwith, last February, for all-round efficiency in flying, ground work and games among third-year students, was presented to Mr. D. E. Eveleigh, an Old Marlburian. Competition was very keen indeed and the first place was closely contested by Mr. Nicholson, who has already gained two other trophies. The trophy, which is a silver cup, may be described as the Hamble equivalent to the Sword of Honour at Woolwich, Sandhurst and Cranwell. It remains the property of the school, the winner receiving a miniature while his name is engraved on the cup itself.

The Sopwith sailing cup has been won for the second successive year by Mr. H. P. Birchenough. This is also regarded as worthy of keen competition, not only from the sporting point of view, but from the training side in that a knowledge of practical seamanship is essential to the modern commercial pilot. Mr. Birchenough also won the Minchin sailing cup.

A new term has just started for the two- and three-year courses. Twelve new students arrived for this, including one from Hungary, one from China, one from Egypt and one from Burma. Other students who joined for short courses included a Frenchman and an Egyptian.

The Air Member for Personnel, Air Marshall W. G. S. Mitchell, C.B., C.B.E., D.S.O., M.C., A.F.C., paid a visit to the school during the month.

Private Flying



SOMETHING DIFFERENT: Last Sunday a Swissair Douglas D.C.3 put into Hatfield for a few minutes. The crew had not come to inspect the Albatross but merely to look at Hatfield as a possible reserve when Croydon is impossible. (*Flight* photograph.)

Another Vega for India

HIS Highness the Maharajah of Jaipur has just taken delivery of a Percival Vega Gull with a Series II Six and v.p. airscrew. The machine is finished in the attractive State colours—pale green fuselage with dark green lettering, and a multi-coloured strip running the whole length—and is being flown out by Flt.-Lt. Hill, the State pilot. On paper the colour scheme may appear too striking, but we saw this machine last week at Croydon and the effect is quite startlingly attractive.

Rhodesian Rally

THE Flying Club of Northern Rhodesia, Lusaka, is holding an air rally during the week-end of October 23-24.

There will be the usual arrival competition, with a handicap; pin-point contest, and efficiency, landing (for the Brooklands trophy), and Concours d'Elegance competitions. A flight of Hawker Furies of the S.A.A.F. will give displays. A dance will be held on the Saturday night and H.E. the Governor, Sir Hubert Young, and Lady Young have extended an invitation to all visiting members of clubs and Services to lunch at Government House on the Sunday.

A mileage allowance of £1 per 100 miles will be paid to all competitors from the borders of the Rhodesias to Lusaka. British private owners have a week in which to make the journey, and no time at all in which to send in their entries. However, the idea of subsidising long-distance arrivals is a good one when in a country where distances are of fairly considerable magnitude.

Reading Redivivus

THE Reading Aero Club, dormant most of this year, has been brought to life again and remodelled. Its hibernation was due to the presence of the workshops and hangars which the expanding Phillips and Powis firm had to build on the available space round the old clubhouse.

Now a new clubhouse has been built at the other end of the aerodrome, away from all the noise and bustle, with a good view of the entire field. The new club has premises—a lounge and a bar, flying office, etc.—in the Falcon Hotel, which has been built by Simonds, of Reading. This, by the way, is the first hotel to be built on a private aerodrome. The lounge is on the first floor, and is open only to club members. Windows run the length of one wall, giving an excellent view of the aerodrome. The bar is on the ground floor, with an entrance off the aerodrome itself. This bar is also reserved for club members.

The flying membership is £1 1s. a year, while non-flying members will have to pay £2 2s. a year. At least three hours' flying must be done every year by the former, but there is no entrance fee. The flying rates (£2 an hour) are the same for dual and solo in order to encourage pilots to take more refresher dual. Non-members must pay £2 10s. an hour solo and £3 dual. The aeroplanes, of course, are Miles Hawk Majors, and Mr. Michael Kimpton is the chief instructor.

Messrs. F. G. Miles (chairman), G. Bennett (treasurer), E. G. Eugster, T. Rose-Richards, J. Galloway and V. Burnett were chosen as the committee at the general meeting of members. A flying committee was also elected. This includes Michael Kimpton and George Miles. Colonel Darby and Sir William Mount have been asked to join the committee.

A party to celebrate the opening of the club has been arranged for Friday, November 12. Anybody who wants tickets should write to Mr. Leonard Hackett, the secretary, at the club.

More Shell Service

THE part played by the Shell organisation in making the world fit for pilots to fly over cannot be over-estimated, and the information collected by their representatives throughout the world is on a monumental scale.

Much of this information is concentrated in the little loose-leaved route schedule books issued by the Shell Aviation Department from time to time. The latest of these is a new edition of the book dealing with the London-Cairo section of the African route.

This has been extensively revised and enlarged to cover both the Athens and Algiers routes and gives, of course, the usual mass of information concerning meteorological conditions, prohibited areas, landing and hangarage charges, and so on, with diagrammatical plans of all the aerodromes, maps showing their exact location and the distance with magnetic bearings of larger aerodromes within a 200-mile radius. On the front cover of this new edition is a somewhat special version of a proportional calculator. The Guide, which costs 10s., can be obtained from the London office of the company or through any bookseller.

South London Centre

UNDER the new arrangements there is every reason to suppose that Gatwick may become extremely popular with private owners and amateur pilots generally during the next year or so. Although both this aerodrome and Gravesend will primarily be Reserve flying centres, the civilian pilot will, from now on, be actively encouraged.

Not only does Gatwick possess an admirable control building which, with a few alterations, may be replanned as a flying and social centre, but there are adequate maintenance and overhaul facilities, ample hangar space and twenty-one lock-ups which are to be rented to private owners at an extremely reasonable figure.

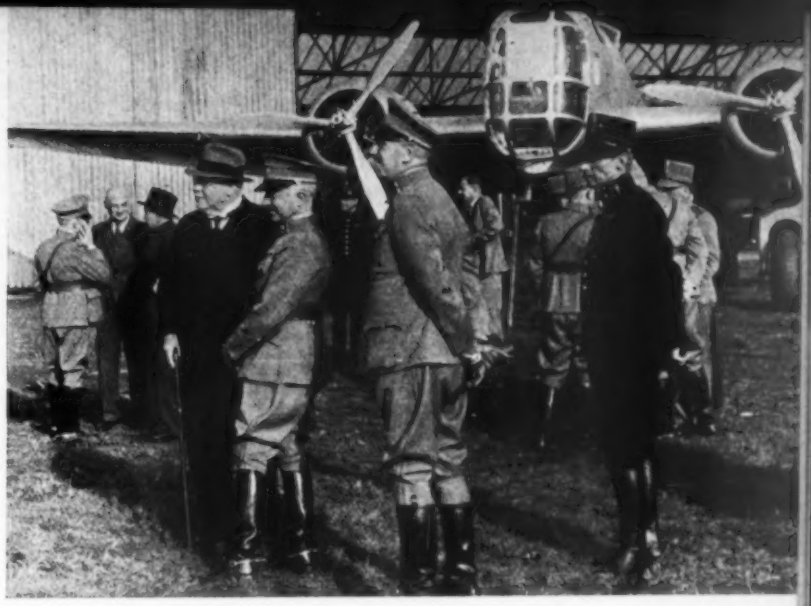
Although, in the days that have passed, Air Travel were always ready and willing to carry out all forms of work on machines, and, in fact, ran a hire service, the private owner was somewhat naturally discouraged by the owners of Gatwick, whose principal tenant was an air line operating company—British Airways. Private flying and air transport operations can never be expected to carry on side by side without friction, and Airports bowed inevitably to the necessities of the regime. The private owner found that he was charged landing fees, that the lock-up rents were high and that the law-abiding business of runway taxying wore out his tail-skid and/or his tyres; he stayed away.

During the past month, with the official notification of the departure of British Airways and arrival of Reserve School equipment, the whole policy for the operation of the airport has been changed. Messrs. Holmes and Kingwill (Air Travel) have joined forces with Airports and will carry out the maintenance work on the Reserve fleet, and the entire atmosphere of Gatwick has already changed quite noticeably. Private owners and club pilots may drop in without fear of rebuff or of tail-skid damage, and new life has already appeared in the form of Mr. Paddy Flynn's flying club.

Needless to say, the station remains on the airport boundary, the electric trains continue to stop, the night-flying equipment is ready for those qualified (or being qualified) to use it, and even the Lorenz approach system will probably be retained for practice by transport and (eventually) by Service pilots. For owners or prospective owners living on the southern side of the Metropolis Gatwick has a number of definite advantages, and for the rest—well, that is a matter of preference and of the overcrowding question at other aerodromes in the area.

HOLLAND BUYS BOMBERS

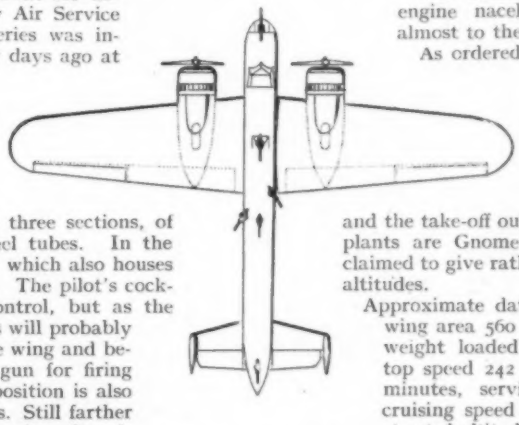
Initial Tests of Pegasus-engined T.5 : Heavy Armament and Fine Performance



Officials of the Dutch Army Air Service at Schipol during preliminary trials of the first Pegasus-engined T.5 bomber. The engines, it will be seen, have gilled cowlings.

THERE are some experts who maintain that Holland should devote her attention in the main to fighters, leaving the provision of bombers to the power or powers which would undoubtedly be allied with her in time of war. She will, of course, need various types, including bombers, for her East Indian Air Force, where she already has a formidable force of Martin B.10 bombers.

Nevertheless, a batch of sixteen Fokker T.5 twin-engined bombers is now being built for delivery to the Netherlands Army Air Service and the first machine of the series was inspected by the authorities a few days ago at Schipol Airport, Amsterdam. It was built in seven months.



A semi-high-wing cantilever monoplane, the T.5 is of typical Fokker construction with two box spars, plywood ribs and bakelite plywood covering for the wing and a fuselage, in three sections, of welded chrome molybdenum steel tubes. In the nose is a turret for a "cannon," which also houses the bomb sight and release gear. The pilot's cockpit is not arranged for dual control, but as the range is less than 1,000 miles this will probably present no hardships. Above the wing and behind the cockpit is a machine gun for firing upward and to the rear. This position is also provided with emergency controls. Still farther aft, as indicated in the accompanying plan, is a gun which may be mounted to fire through the floor or may have a special mounting in the cabin wall. The operator of this gun is also the wireless operator.

The fuselage tail section of the T.5 is in the form of a Plexiglass cone, rotatable on a horizontal axis following the practice originated in the Fokker attack machine *Le Faucheur*, introduced at the last Paris Show. Twin fins and rudders are incorporated and trimming tabs are used.

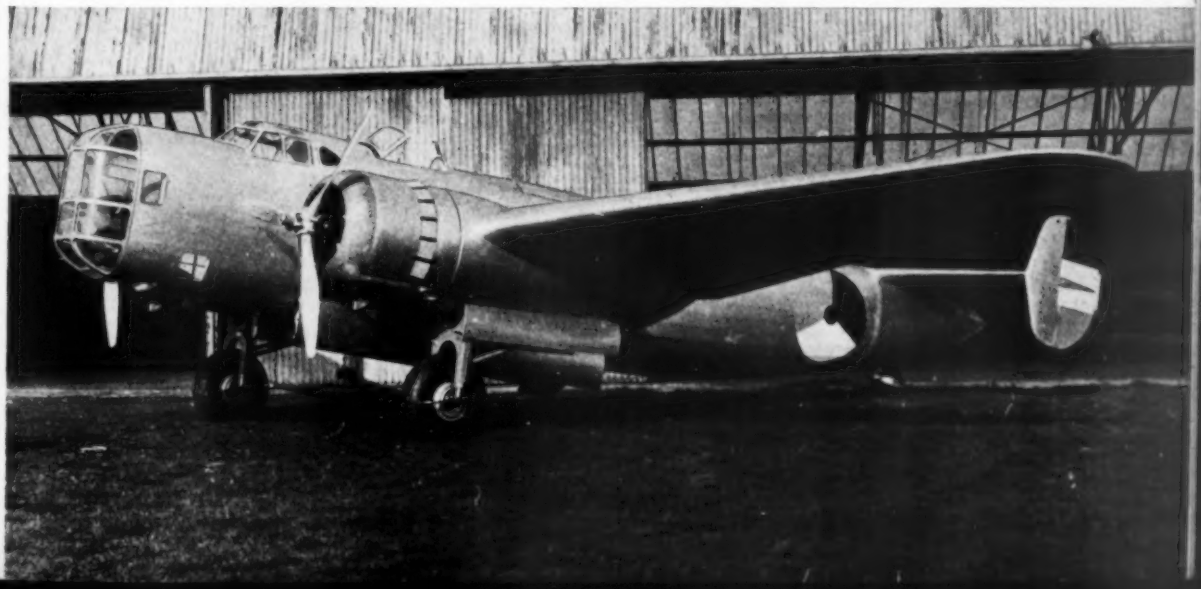
Bombs are stowed in the section of the fuselage below the wing, this region being provided with appropriate "clam shell" doors.

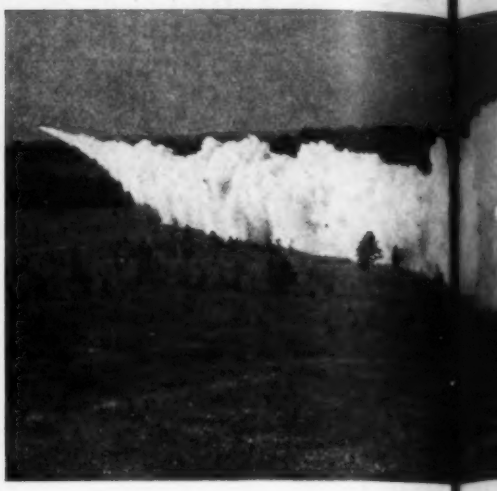
The undercarriage is retractable into the engine nacelles and flaps extend inboard almost to the fuselage.

As ordered by the Dutch Government, the T.5 is fitted with a pair of Bristol Pegasus XX engines. The Pegasus XX is fully supercharged and delivers 820 h.p. at 2,250 r.p.m. at 9,000ft., the maximum power at slightly higher altitudes being 925 h.p. and the take-off output 830 h.p. Alternative power plants are Gnome Rhone 14 NO-01s, which are claimed to give rather more power at slightly higher altitudes.

Approximate data for the T.5 are: Span 69ft., wing area 560 sq. ft., weight empty 9,920 lb., weight loaded (normal condition) 15,652 lb., top speed 242 m.p.h., climb to 16,400ft. 12.6 minutes, service ceiling 26,300ft., range at cruising speed in still air, with full tanks and at rated altitude, 870 miles.

The use of Bristol Pegasus engines in the T.V. may be significant in that the Dutch military air services have previously shown a partiality for American Wright Cyclones. Undoubtedly the Dutch authorities would have given a good deal to have been able to specify the new Pegasus XVIII with two-speed blower. This unit would give improved take-off characteristics and performance.

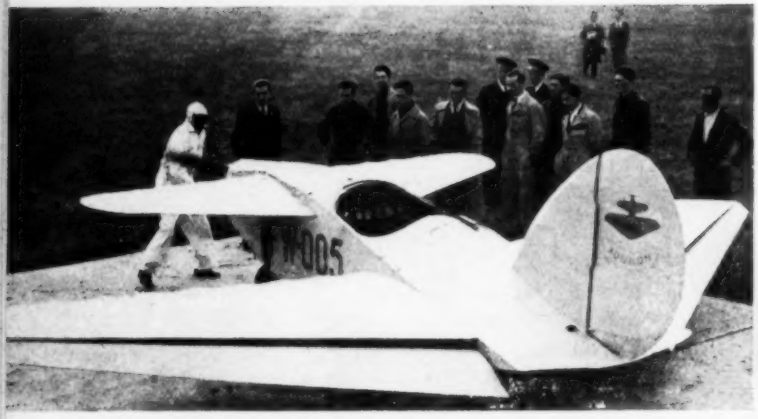


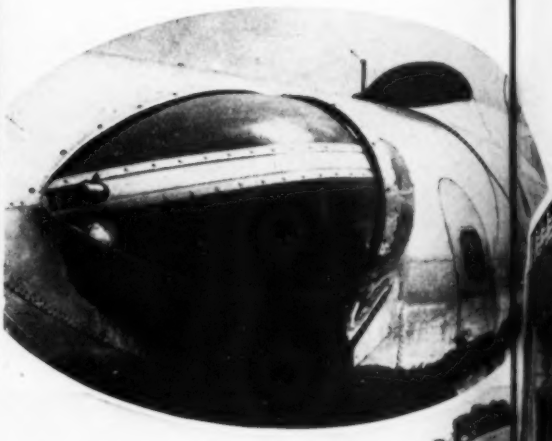


(Left) Lethal Trails : Northrop A.17 attack machi... the U... demonstrate gas dispensation at Muroc ... manoe...
(Above) Drawing the curtain : a spectacular smoke-... laid b... at the U.S. chemical warfare school at Edgew... Arsenal.

NEWS in VIE...

Some Oddities and Othe... fr... America and Elsew...





(Above) Something novel in the French "prototype tour" —the Claude *Canard Aquilon*. It is said to cruise at 90 m.p.h. on 40 h.p.
(In oval) One of the 'blister' turrets of the Boeing YB-17 bomber.
(Below) Hackney and Gipsy : An amusing contrast in travel modes snapped recently at Inverness Airport.

ttack machin the U.S. Army Air Corps
ion at Muroc manœuvres.
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n VIEWS

nd Othe e from
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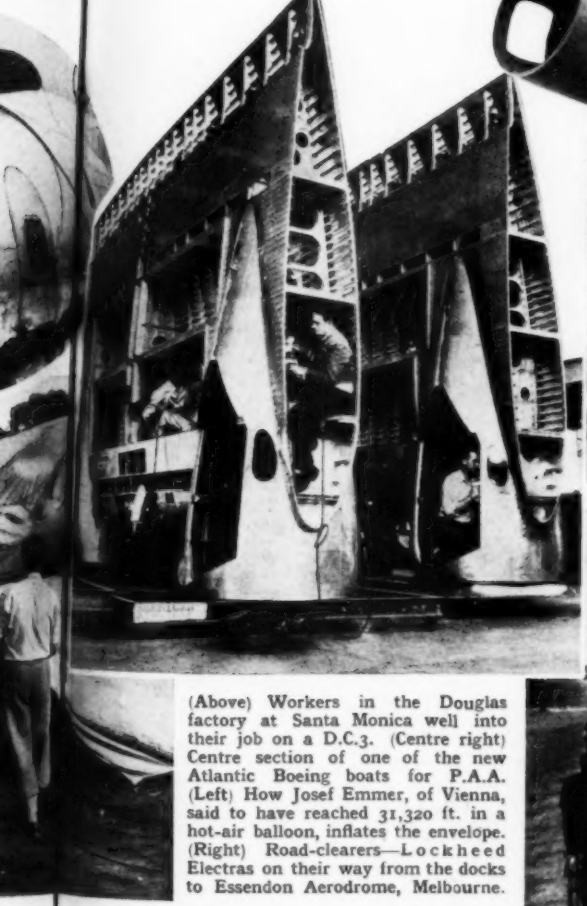
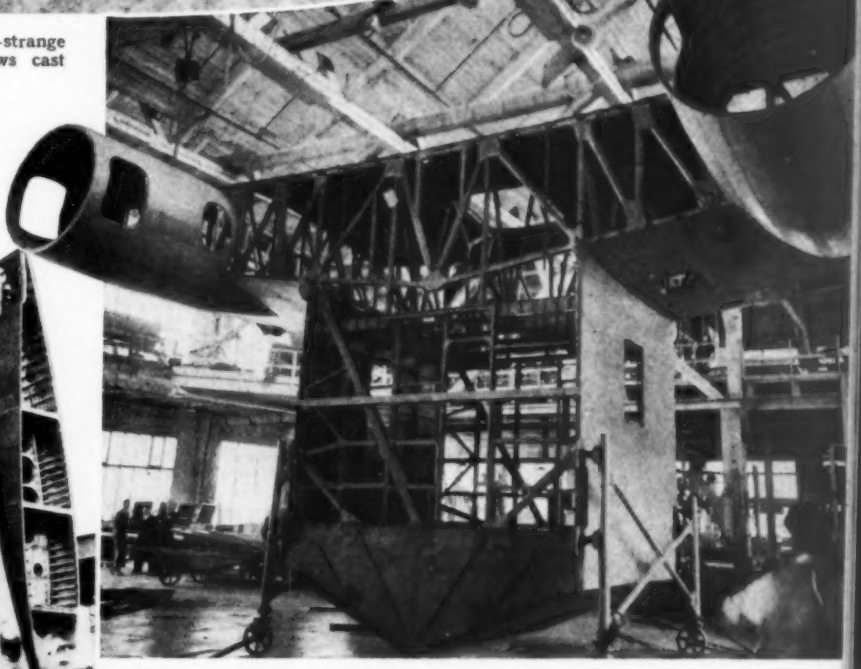
Flight of fancy—strange duck-like shadows cast by a formation of U.S. Army Northrops.





(Above) Workers in the Douglas factory at Santa Monica well into their job on a D.C.3. (Centre right) Centre section of one of the new Atlantic Boeing boats for P.A.A. (Left) How Josef Emmer, of Vienna, said to have reached 31,320 ft. in a hot-air balloon, inflates the envelope. (Right) Road-clearers—Lockheed Electras on their way from the docks to Essendon Aerodrome, Melbourne.

The TREND of INVENTION

Recent Aeronautical Patents Reviewed

Servo Actuation of Control Surfaces

THIS patent, which comes from the National Physical Laboratory, describes an arrangement for the servo control of rudders, elevators or similar surfaces in which servo actuation is used in conjunction with the main control.

The aim of the device is that the servo shall be self-locking against flutter, but not against the normal operating force, so that the "feel" of the control is not impaired.

The pilot's control cables rotate a drum which in turn rotates a second drum and also a worm, which latter is in engagement with a worm wheel attached to the main control surface. Cables pass from the second drum to operate the servo-flap.

The irreversibility of the worm prevents the main flap from flutter relative to the fixed surface, and relative flutter between the main flap is prevented, since they can only move in a given phase relation. Other methods by which this effect may be obtained are described.—*Patent No.* 460841: *D. Ll. Ellis.*

Alternative Control System

VARIOUS systems of controls have been devised to enable a machine to be controlled from two different positions. For example, there may be two complete, independent and separately operable sets of controls, one set being operated from either one or other of the control stations and the other set from only one of the stations. This enables an instructor to rectify the effects of any faulty manœuvres made by a pupil. Another system is the complete duplication of controls, and while this gives increased safety in flight, it does not function in the event of a fault (e.g., seizure) in the control surface to be operated.

This difficulty is overcome in the system now proposed, which is divided into two distinct halves. Each control station is positively connected to half of the rudder surface, half of the elevator surface, and half of the aileron surface. Separate connections such as clutches connect the two halves, both at the controlling and controlled ends, and by a suitable manipulation of these any control can be isolated from one or other operating station and connected to the other operating station. Further, all the controls can be connected to both stations so that the machine can be completely operated from either station.

In an alternative arrangement the connection from each station to each control surface may, at some intermediate point in its length, be capable of being coupled through a clutch to the corresponding connection of the other half, thus giving added possibilities of inter-coupling to minimise the effect of failure of various parts. The military value of this experiment is obvious.—*Patent No.* 464548: *Junkers Flugzeugwerk Aktiengesellschaft.*

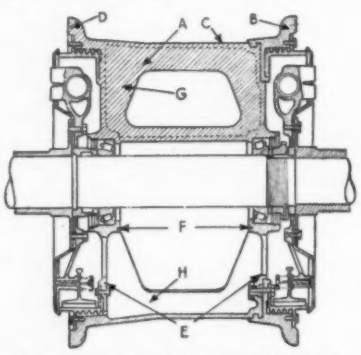
Flap Operation

IN the operation of certain types of flaps it is necessary not only to impart a rotational motion to them, but in addition to move them bodily in a rearward direction. Means for effecting these two movements simultaneously, i.e., rotation and translation, are described in this patent, the mechanism being housed in the wing.

One form of construction is shown in the illustration. The linkage is pivoted at A and B to the wing structure, and at C and D to the flap. When the main operating rod E is moved to the right, the flap F moves rearwards and turns, assuming the new position shown at F'.—*Patent No.* 450276: *Handley Page, Limited, G. V. Lachmann, G. R. Volkert and W. J. Dare.*

Wheels

IN order to increase the strength of an aircraft wheel and at the same time to keep the weight as low as possible, it is proposed to construct it with the rim, hub and side-members as a one-piece casting, one rim flange being a separate member.



A section through the Bendix wheel and brake. (Patent No. 466167.)

The wheel consists of a cast body A with a separate cast member B forming the second rim flange, the two being held together by a bayonet joint. It will be seen that the main casting consists of a rim C, a side flange D, side walls E and hub sections F. There are also stiffening webs G and H, three of the former and six of the latter. The brake drums are secured in recesses on each side of the wheel.—*Patent No.* 466167: *Bendix Aviation Corporation.*

Tail Wheels

THE purpose of the present invention is to provide a tail wheel which has a castoring action, the resistance of which can be varied at will by the pilot.

In the usual construction, a curved guide or track is provided which is associated with the swinging arm on which the wheel is mounted, and a spring-loaded check member slides or rolls on this curved track. When the tail wheel is in its central position, the check member is at the lowest position on the track, and as the tail unit is deflected laterally, the check member is raised and the spring force increases and offers an increasing resistance to the deflection. On account of the restoring force required for small deflections a high initial stress of the springs is often unavoidable if a definite location of the middle position is to be effected.

In the arrangement described in this patent the check member is held on its track by fluid pressure exerted on a piston associated with the check member and controlled from a unit operated by the pilot in the cockpit. In this way a high pressure on the piston holds the wheel firmly in its centre position, a medium pressure allows a restricted castoring action while a low pressure permits a full rotation of the tail wheel. Thus it is possible to have the fixed mounting when landing or taking off, the limited swinging for taxying on the aerodrome and the free swinging mounting when bringing the aircraft into the hangar.—*Patent No.* 465714: *Elektronmetall G.m.b.H.*

Variable-pitch Airscrews

IF the best results are to be obtained throughout the working range of conditions, the pitch of airscrew blades must be varied in accordance with some law that takes into consideration all the factors involved.

The power absorbed by a given airscrew varies with the cube of the angular velocity, with the density of the medium and with a coefficient the value of which is determined by the pitch, and by the ratio between the travelling velocity and the angular velocity of the airscrew.

An automatic pitch variation law would therefore be one in which the power absorbed varied only with the cube of the angular velocity and independent of the density of the medium and the travelling velocity.

The system described in this patent is claimed to fulfil the above conditions. The hub is loosely mounted on its driving shaft, and the blades are capable of rotation about their axes by the driving torque, which tends to turn them against the centrifugal force generated by masses associated with the blades.

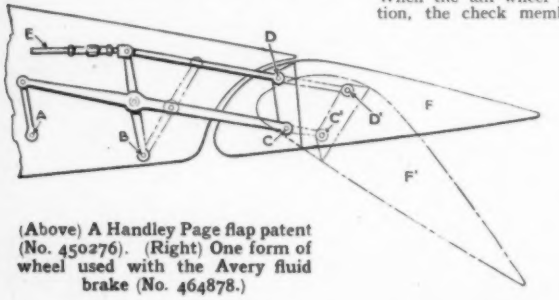
The pitch is thus determined by the balance of the couple due to the centrifugal force of the weights.—*Patent No.* 460332: *Societa Anonima Alfa Romeo.*

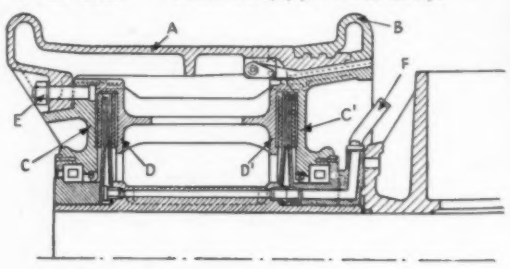
Wheels and Brakes

IN an earlier patent (No. 392603) a disc type of brake was described, and the present invention is concerned with the incorporation of this brake in an aeroplane wheel.

A section through half of the wheel is shown in the illustration below, from which it will be noted that the rim A has one flange B which is detachable to enable the tyre to be fitted. The rim is carried on the two brake castings, each of which consists of an outer plate C and C' and an inner plate D and D'. The outer plates are carried on ball bearings on the hub and are formed with tapered surfaces at their peripheries, on which the rim engages, being fixed by bolts E. Fluid under pressure, admitted through the connecting pipe F, applies the brakes.

The important feature of this construction is that the castings of the disc brakes form a support for the rim of the wheel and thus absorb the loads imposed on the rim edges.—*Patent No.* 464878: *W. L. Avery.*





(Above) A Handley Page flap patent (No. 450276). (Right) One form of wheel used with the Avery fluid brake (No. 464878.)

ENGINES at MILAN

Two-Row Radials Well Represented : Variety of Italian Liquid-Cooled Units

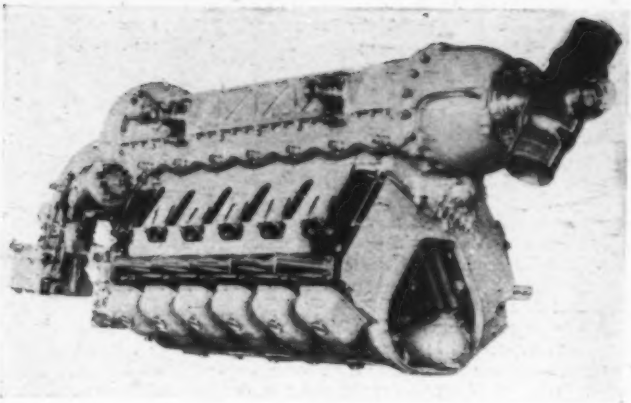
FEW countries other than Great Britain and France can show such a variety of engine types as Italy, and even though British and American manufacturers are not represented at the Milan Show, except by certain of their designs built under licence, almost every known form of engine is to be seen there.

High-powered fourteen- and eighteen-cylinder two-row radials are represented on a number of stands. One such unit, still in the experimental stage and for which no figures are divulged, is the two-row eighteen-cylinder Alfa Romeo, which looks rather a poppet-valve Hercules, or a two-row Pegasus or Mercury. The ultimate output of this engine must be in the neighbourhood of 1,500 h.p.

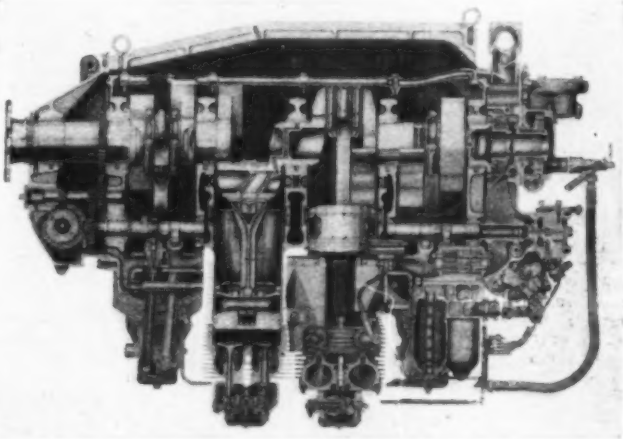
The Fiat Company show two geared and supercharged eighteen-cylinder radials, the 1,100 h.p. A 80 R.C. 20, and R.C. 41. The R.C. 41 has a rating of 1,000 h.p. at 2,100 r.p.m. at 13,450 ft. and gives 1,030 h.p. for take-off. A fourteen-cylinder engine, the A 74, R.C. 38, made by the same firm, gives 840 h.p. at 2,400 r.p.m. at 12,500 ft.

The Piaggio concern, which produced the fourteen-cylinder radial with two-stage blower for the last Italian altitude record, has a similar unit, the eighteen-cylinder P. XII R.C. 40, which delivers 1,600 h.p., and the improved P. XI. R.C. 30, known as the R.C. 40, giving 1,000 h.p.

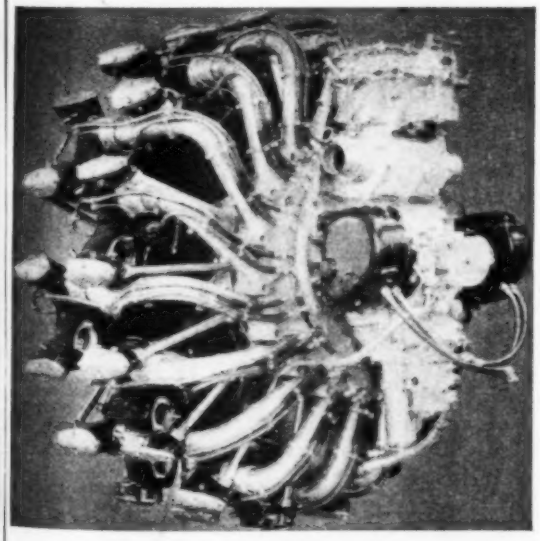
Primarily known for their liquid-cooled vee-twelve units, Isotta-Fraschini also figure in the radial market with their Astro model 140 R.C. 35 fourteen-cylinder radial which gives 770 h.p. at sea level and 820 h.p. at rated altitude. Two smaller seven-cylinder units, the fully supercharged 7 C. 40 (400 h.p. at 13,120 ft. at 2,000 r.p.m.) and the 7 C. 21, giving 420 h.p. at sea level, are also on view.



A Czechoslovakian exhibit, the Walter Sagitta has been greatly developed since its appearance at Paris. A 100-hour type test at 570 h.p. output has been completed, and as much as 650 h.p. has been taken from the engine in a special category. The fully supercharged Sagitta II R.C. "cannon-engine" at Milan has a normal rating of 520 h.p. at 13,450 feet.



A good idea of modern practice in the design of light inverted engines can be gained from this drawing of a sectioned German Argus As.10 C. engine. The inverted, air-cooled vee-eight layout is rather strange to British eyes but is used extensively in Germany. The maximum output is 240 h.p. Another well-known example of this class of engine is the Hirth HM. 508E.



"Doppia stella," "Doppelstern" (or double-star) motor, the Fiat A. 80 R.C.41 is an eighteen-cylinder geared and supercharged radial rated at 1,000 h.p. The *potenza ideale*, which corresponds to the French *équivalent de puissance*, is 1,630 h.p.

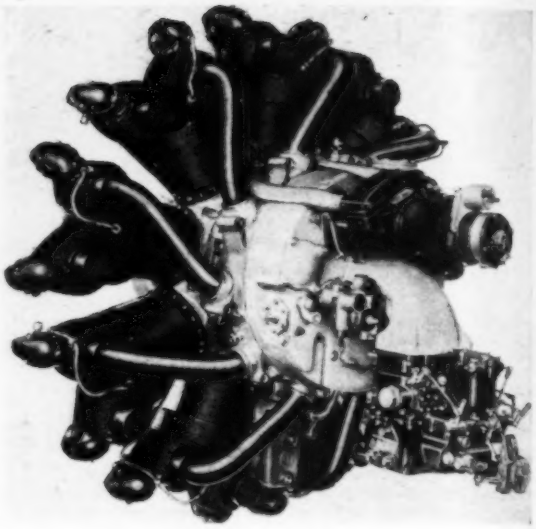
Gnôme-Rhônes show the very small diameter two-row M.14 engine which created a stir on its first appearance at the last Paris Show. It is rated at 680 h.p. at 13,100 ft. A new large two-row engine, the P.18, presumably a modified L.18, is rated at 1,600 h.p. at 2,300 r.p.m. and 14,760 ft. The take-off power is given at 1,650 h.p.

Although Italy boasts no "X"- or "H"-type engines, there are several of "vee" layout and inverted-vee units of German and Czechoslovakian manufacture are represented. The names of Fiat and Isotta-Fraschini come to mind at once in the large liquid-cooled twelve-cylinder field. Air-cooled Pratt and Whitney engines are built under licence by Fiat, but in design the unsupercharged V-12 A.30 RA (bis) follows Fiat principles of long standing.

The Junkers Jumo 210 inverted vee-twelve unit has now been joined by a larger model, the Jumo 211. This has a reduction gear of spur type. Its take-off output is claimed to be 1,100 h.p. At altitude the maximum is 945 h.p.

The orthodox 12 Y crs. liquid-cooled Hispano-Suiza appears unchanged, while the Walter Sagitta models have improved ratings. The moderately supercharged Sagitta I

A new nine-cylinder radial, the Bramo 323 J Fafnir, powers the Dornier Do.19 experimental bomber. A Farman-B.M.W. reduction gear of 1.61 : 1 ratio is fitted and the engine is supercharged for operation at 13,780 feet.



has a Farman reduction gear and is rated at 5,250 ft., while the Sagitta II has an upturned spur-type reduction gear for cannon mounting and is fully supercharged with a normal rating of 500 h.p. at 12,150 ft.

At a time when the two-row radial is in the ascendancy it seems strange that a new design of large nine-cylinder, single-row engines should appear, particularly as Germany holds the licence to build Pratt and Whitney engines. The Bramo Fafnir's 850 h.p. should, however, have useful commercial applications.

A design not developed in this country is the inverted vee-eight air-cooled layout. Hirth and Argus models have been in wide use in Germany for some time in what might be called the higher-powered private owner and lower-powered commercial category, and examples of these appear at Milan.

The Czech name of Walter creeps into almost every category of aero engine, and there are very few firms which produce such a varied range in size and power rating. The tiny two-cylinder Atom is of only 1,100 c.c. capacity and gives a maximum of 28 h.p. at 3,000 r.p.m. The smallest inverted four in line is the Mikron, which is now in Mark II form, giving 62 h.p. for take-off. Another ultra-light unit is produced by C.N.A. at Rome.

Maker, Type, and Nationality	No. and Arrangement of Cyls.	Cooling.	Capacity (litres).	Normal Power (h.p.).	Dry Weight (lb.).
ALFA ROMEO (Italy):					
110 I.	4 I.L.	A.	6.124	120	288
115 I.	6 I.L.	A.	9.186	190	463
D.2 C.30	9 R.	A.	13.741	250	617
126 R.C.34	9 R.	A.	28.63	750	1,069
126 R.C.10	9 R.	A.	28.63	800	1,058
135 R.C.33	18 2R.	A.	—	—	—
ARGUS (Germany):					
As. 10C. III	8 I.V.	A.	12.7	200	465
BRANDENBURG (Germany):					
Bramo SH. 14 A.4	9 R.	A.	7.7	128	297
Bramo Fafnir 323J.	9 R.	A.	26.82	830	1,201
C.N.A. (Italy):					
C. II (bis)	2 H.O.	A.	1.4	38	29.6
C. VI R.C.43	6 I.L.	A.	4.2	150	407
FIAT (Italy):					
A.70	7 R.	A.	8.361	205	368
A.30 R.A.	12 V.	Lq.	24.48	550	1,058
A.74 R.C.38	14 2R.	A.	31.250	840	1,256
A.80 R.C.41	18 2R.	A.	45.720	1,000	1,598
A.80 R.C.20	18 2R.	A.	45.720	1,100	1,598
A.S.6 (Racing)	24 V.	Lq.	51.100	3,100	2,050
HIRTH (Germany):					
HM. 60R.	4 I.L.	A.	3.6	66	203
KM. 504A.	4 I.L.	A.	3.98	75	308.6
HM. 506A.	6 I.L.	A.	5.97	135	327
HM. 508H.	8 I.L.	A.	7.96	200	441
HISPANO-SUIZA (France):					
14 AA.	14 2R.	A.	45	980	1,311
14 AB.	14 2R.	A.	32	670	1,014
12 Yrs.	12 V.	Lq.	36	880	1,036

Maker, Type, and Nationality.	No. and Arrangement of Cyls.	Cooling.	Capacity (litres).	Normal Power (h.p.).	Dry Weight (lb.).
ISOTTA FRASCHINI (Italy):					
Asso Caccia	12 V.	A.	20.61	440	840
Asso 120 I.R.C.C.40	—	—	26.685	665	1,146
Asso XI R.2.40	12 V.	Lq.	32.646	836	1,356
Asso XI R.2.C.15	12 V.	Lq.	32.646	880	1,356
Asso L.121 R.C.40	12 V.	Lq.	32.646	900	1,356
Asso XI R.	12 V.	Lq.	32.646	670	1,330
Asso 750 R.C.35	12 V.	Lq.	47.10	870	1,724
Astro 7 C.40	7 R.	A.	20.8	400	723
Astro 7 C.21	7 R.	A.	20.8	460	723
Astro 140 R.C.35	14 2R.	A.	34.688	820	1,290
JUNKERS (Germany):					
Jumo 210	12 I.V.	Lq.	19.7	550	974
Jumo 211	12 I.V.	Lq.	35.0	700	1,278
PIAGGIO (Italy):					
P. VII C.16	7 R.	A.	19.334	460	716
P. VII C.45	7 R.	A.	19.334	450	750
P. X R.	9 R.	A.	24.858	700	948
P. IX R.C.40	9 R.	A.	24.858	600	981
P. XI R.C.40	14 2R.	A.	38.6	1,000	1,444
P. XII R.C.40	18 2R.	A.	56.904	1,600	1,764
GNOME-RHONE (France):					
M.14	14 2R.	A.	18.98	680	923
P.18	18 2R.	A.	54.24	1,500	1,874
WALTER (Czechoslovakia):					
Atom	2 H.O.	A.	1.1	25	88
Mikron II	4 I.L.	A.	2.33	60	134
Minor 4	4 I.L.	A.	4.0	85	205
Major 4	4 I.L.	A.	6.124	120	308
Major 6	6 I.L.	A.	9.2	190	386
Sagitta I.R.C.	12 I.V.	A.	18.37	470	794
Sagitta II R.C.	12 I.V.	A.	18.37	435	860
Bora II	9 R.	A.	9.35	210	364
Bora II R.	9 R.	A.	9.35	230	379
Super Castor I R.C.	9 R.	A.	18.8	400	782

R. = Radial. 2R. = 2 Row R. I. = Inverted. H.O. = Horizontally opposed. V. = "V" Formation. L. = In Line. Lq. = Liquid. A. = Air.

The Hafner's Tie-rods

"WE can see the limitations of fixed wings—we must beware of the limitations of fixed ideas; and if we are to avoid flying and thinking in circles we must make the wing rotate." This rather neat epigram concludes the lecture which Mr. R. Hafner is giving to the R.Ae.S. to-night. His subject is the Hafner Gyroplane, and he deals with it both historically and mathematically.

The Hafner A.R.III has already been described in *Flight*. The outstanding feature of the Hafner rotor head is the tie-rod which supports each rotor blade, affording it freedom to change its angle of incidence. This tie-rod also carries the centrifugal load of the blade, and it is no exaggeration to say that on the way in which the rod stands up to the loads imposed upon it depends the success of Mr. Hafner's scheme of incidence change. Fortunately, he is able to reassure his audience on this score. A tie-rod was given a very thorough test for possible fatigue effects, due to the torsional oscillation. A tensile load of 7.5 times the normal was applied, and a torsional oscillation with an amplitude of more than three times the maximum possible in the aircraft. The frequency was about four times that which occurs in flight. The tie-rod underwent three million reversals (more than 60 hours) without showing signs of fatigue or strain. Thus it seems that one need have no fear on that score.

Reduced Profits

PRESUMABLY arising out of the Air Ministry's statement, at the inception of the present expansion scheme, that aircraft constructors' profits would be limited, reductions have been made in Hawker dividends. The Ordinary and "A" Ordinary dividends are reduced from 20 to 17½ per cent., apparently as a result of a drop in earnings disclosed by the accounts for the year ended March 31, trading profits being £140,494, against £196,101. After allowing for income-tax, appropriation to capital redemption reserve fund, and Preference dividend, practically the whole of the available profit remaining is absorbed by the dividend.

AEROBATICS at SEVENTY-ONE

Some Reflections by a Septuagenarian Private Owner—

DOUGLAS FAWCETT

THE Editor has asked me to give my "impressions" when, as an aspirant of 71, I was making good in the full course of aerobatics at Heston. I reply by stating an old sportsman's view not only of aerobatics, but of joy-flying in general.

I took my "A" licence, which is best regarded as an encouragement to train seriously, at 68, finding that the initial difficulty of learning to fly had been exaggerated absurdly by the popular Press. My conclusion was (and is) that ordinary flying, the technique of good approaches and landings excepted, is easy, given a first-rate instructor. And to-day I consider ordinary touring, e.g., a trip from Hatfield to Switzerland, easy so far as the mere flying is concerned. One sits behind an engine with little to do, and whether one flies at 100 or 150 m.p.h. hardly matters. Travelling is the joy; for do not all aircraft, moving about 4,000ft., seem to crawl across the vast landscape? High speed, it is true, is safe normally; it is easier to race over the fields of France than to explore ridges and pine forests in Switzerland at 60 m.p.h. With high speed, too, the drift problem is less serious, but this brings us to a new issue. The real difficulty of the tourist is not flying as such, but navigation, and this latter aspect we must treat with due respect. Even an accurately held "compass course, as Capt. Ferguson, of Heston, tells us, "requires more skill than the whole art of flying." The long-distance flyer, if he is not the navigator as well, wins only a bubble reputation. Even his endurance may be overstressed; a mountaineer would laugh at the ordeal which such a pilot is said to undergo. Try the traverse of the Obergabelhorn!

At the Right Time

Air touring, I contend, can be an excellent, unexacting sport for elderly folk who have avoided the bar and whose hearts, arteries and nerves are beyond reproach. But let them undertake their navigation in fine weather. Clouds that lie on the hills bring trouble, and who likes blind-flying through fog? I have blind-flying instruments in my own machine, but for emergencies only.

I found my baptism of the air pleasant because I was trained by Capts. Baker and Davy, instructors who teach one not only to ride the winds, but also thoroughly to understand the process. However that be, I became expert at ordinary flying and wanted more; felt that my dreams of mastering the air were unrealised; and turned to stunts. One day I asked Capt. Davy to show me how a loop was done; he did one, and I succeeded in doing another, not too badly. Stalled turns and the rest followed. What of the difficulties? I cannot recall any serious ones except in the case of slow rolls, which require very accurate control of the rudder bar and stick. These rolls are difficult on comparatively low-powered machines, of the kind usually found at schools, owing to the need of controlling the nose; in the case of powerful machines, I am told, the nose is dealt with easily. I have little to say about my emotions when practising aerobatics, being much too interested in what is being done to analyse my private feelings. But doubtless the joy of overcoming difficulties, of taking liberties with the treacherous medium in which I move, dominates.

Mr. Douglas Fawcett, the author of this article, with his Hornet Moth. An experienced mountaineer, he spends much of his time in Switzerland, flying blissfully in all sorts of weather, over, around and among the peaks which he knows so well. He is the brother of Colonel Fawcett, who disappeared while exploring the Amazon.

Mishaps? Can one speak of mishaps when practising at 3,000ft.? I recall, however, an involuntary spin off a loop, another off a stalled turn, but these are incidents of training, not accidents. More serious was an air-lock, the engine spluttering and not regaining its power till the craft was sixty feet above the aerodrome on the way to land. When flying upside down one afternoon I lost my hotel key, chain and brass block—an amusing thing to write about now, but by no means agreeable when I reached my rooms that night.

After practising aerobatics one is sure of being able to master the machine in any positon which it may take up, and this is a source of complete confidence in times of trial. One's ordinary flying also becomes very easy. Still, for me the chief recommendation of stunts is that they are such glorious fun.

A suggestion, which has the support of an able instructor, to close. If the beginner is trained in a machine which is not "too safe," too easily mastered, but which compels him to know his job, he can pass to the flying of other machines without much trouble. But this statement holds true only of ordinary flying. In the case of aerobatics one must become familiar with a special type, and make this for the while the sole object of one's affections.

All About 1938 Motoring

THE Automobile Exhibition at Earls Court (October 14 to 23) is being marked by three specially enlarged Show issues of *The Autocar*. The first, published last Friday, October 8, was the annual special Buyers' Guide Number; the second, to-morrow, October 15, forms a complete and profusely illustrated Show Report; while on October 22 the issue will be devoted to a critical Show Review, covering important developments. The price of each issue is 6d.

Practical Training

MR. G. B. S. ERRINGTON'S ground engineer companion on his recent delivery flight of an Airspeed Envoy to China was Mr. R. O. M. Graham, a student of the Airspeed Aeronautical Engineering College.

This is the second time an A.A.E.C. student has flown to China, Mr. W. F. Locke having accompanied Flt. Lt. Colman, the firm's chief test pilot, on a similar flight successfully completed last January.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

THE COMMAND IN INDIA

Air Marshal P. B. Joubert de la Ferté, C.B., C.M.G., D.S.O., has taken up the post of Air Officer Commanding, Royal Air Force, India.

Air Chief Marshal Sir Edgar Ludlow-Hewitt, K.C.B., C.M.G., D.S.O., M.C., the previous A.O.C. in India, has become A.O.C.-in-C., Bomber Command, in succession to Air Chief Marshal Sir John Steel, G.C.B., K.B.E., C.M.G.

EQUIPMENT AND ACCOUNTANT OFFICERS.

As a temporary measure, during the period of rapid expansion of the Air Force, a limited number of flying officers of the Equipment and Accountant branches, other than officers promoted from warrant rank, may be promoted to the acting rank of flight lieutenant before they complete six years' service as flying officer and therefore become eligible for substantive promotion under the normal procedure.

Officers so promoted will, until they become normally qualified by time for promotion to flight lieutenant, receive the special rates of pay of 19s. a day (Equipment branch) and 20s. a day (Accountant branch): their service as acting flight lieutenants will not count for seniority or service in the substantive rank of flight lieutenant.

REMUSTERING

It has been decided as a temporary measure to reduce the qualifying period of service in the trades of wireless operator and armourer for the selection of airmen for conversion to wireless operator mechanic and fitter (armourer) from eighteen months and three years, respectively, to one year.

AIR FORCE LIST

The October issue of the *Air Force List* has now been published. It can be purchased (price 3s.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

R.A.F. DINNER CLUB

The sixteenth annual dinner of the Royal Air Force Dinner Club will be held at the Connaught Rooms, London, on Friday, October 22, at 7.45 for 8.15 p.m. Information and tickets may be obtained from the Hon. Secretary, Room 436, Adastral House, Air Ministry, Kingsway, London, W.C.2.

R.A.F. VOLUNTEER RESERVE (MEDICAL BRANCH) INSTITUTED

The Air Ministry announces that a new branch of the Royal Air Force Volunteer Reserve is to be established for medical officers as a reserve for the reinforcement of the Royal Air Force in times of national emergency.

Applications are invited immediately from suitable candidates, who must be qualified to practice medicine and surgery, be registered under the Medical Acts in force in the United Kingdom, and be below the age of 40. Applications should be sent to the Secretary, Air Ministry (S.7.e), Kingsway, London, W.C.2. The initial period of service will be five years. Candidates will normally be entered in the rank of Flying Officer and will be eligible for promotion to Flight Lieutenant after two years' approved service. Those with exceptional qualifications may be appointed in a rank higher than Flying Officer.

Officers will be required in their first year of service to attend an Air Force unit for 18 working days' training in the duties of a medical officer. In subsequent years they will be liable, if called upon, to attend for 12 working days annually.

Officers will receive a retaining fee of £15 a year and the pay and allowances of their rank during periods of training. They will also receive on entry an outfit allowance of £25.

No. 2 FLYING TRAINING SCHOOL

The undermentioned officers and airman have been awarded special assessments on completion of a course of flying training at No. 2 Flying Training School, Digby:—

Special Distinction

A.P/O. L. W. Skey.

Distinguished Pass

A.P/O. T. L. Howell and Corpl. Houghton, H. J.

No. 3 FLYING TRAINING SCHOOL

The undermentioned officers and airmen have been awarded special assessments on completion of a course of flying training at No. 3 Flying Training School, South Cerney:—

Distinguished Pass

A.P/O.s P. L. Billing, R. V. Jeff, and J. Jefferies, L.A/C.s Graham, J. R., and Steed, L. C.

No. 6 FLYING TRAINING SCHOOL

The undermentioned officers have been awarded special assessments on completion of a course of flying training at No. 6 Flying Training School, Netheravon:—

Distinguished Pass

A.P/O.s T. M. Bulloch, H. G. F. Gaubert, and D. S. Thom.

No. 11 FLYING TRAINING SCHOOL

The undermentioned officers and airman have been awarded special assessments on completion of a course of flying training at No. 11 Flying Training School, Wittering:—

Distinguished Pass

A.P/O.s W. D. Hodgkinson, D. I. Fairbairn, D. S. Hoare, and R. A. Thomson, L.A/C. Steel, H. A.

FLYING ACCIDENT

The Air Ministry regrets to announce the following accident:—

Flt. Lt. Archibald Harold Houghton, Flt. Lt. Harold George Adams and F/O. Edward Gough lost their lives in an accident which occurred at Mudawara on October 8 to an aircraft of the Royal Air Force Station, Amman, Palestine. Flt. Lt. Houghton was the pilot and the other two were passengers.

COMPETITION FOR PERMANENT COMMISSIONS

The undermentioned flying officers are accorded permission to sit for the examination to be held on November 2 and 3, to compete for permanent commissions in the General Duties Branch:—

Everest, M. H. de L., Hathorn, J. W., Fleming, P., Harrison, G. E., Appleby, T. G. W., Dupont, R. E., Groom, A. D., Mitchell, C. H., Vickers, T. R., Casley, W. E., Curry, S. E. F., Glover, J. N., Hallam, M., Welland, R. D., Wood, V. C., Church, W. C. A., Nedwill, R. J. C., Pinfold, H. M., Thompson, J. M., Barker, J. L., Burgis, F. S. D., Campbell-Voullaire, E. G., Oats, V. R., Woodhouse, H. de C. A., Laws, L. M., Manning, F. J., Carr, W. E., Forshaw, R. G., Leggate, J. R., Parnaby, G. S. A., Bitmead, E. R., Cattell, D. E., Crawford, R. C., Garvin, G. D., King, C. F., Kitching, G. A., Morris, B. G., Smith, S. R. R., Wood, C. A., Torrens, D. C., Joslin, J. D. C., Churchill, A. J. F., Richmond, G. A., Fleming, C. N., Sharp, R. E., Burns, R. E., Cruickshanks, G. L., Fenwick-Wilson, R. M., Fidler, G. M., Frost, D. P., Irens, H. J., Nicholls, C. W. K., Rampling, K. J., Samson, B., Barton, W. F., Batchelor, K. S., Berrill, E. R., Fothergill, C., Kearney, W. H., Leggate, A. R., Locker, W. A. L., Mellor, K. J., Mercer, J., Revell, J. D. T., Scott, W. I., Voyce, J. B., Black, J. B., Coad, R. M., Corkery, M. P. C., Duncan, J., Holmes, F. A., Jameson, T. S., Kitson, J. H., Millar, J. C., Newall, F. L., Saunders, P. H. R., Spencer, D. G. H., Stevens, P., Stickley, L. J., Surplice, W. E., Wasse, K. M. M., Wells, W. G., Burns, R. J. B., Case, A. A., Murray, A. D., Edwards, R. I. K., Florigny, C. E. E., Larkin, H. R., McBratney, V. H. A., Maguire, H. J., Meares, R. C., Oliver, D. C., Pawson, G. I., Pettit, J. A. K.

ROYAL AIR FORCE GAZETTE

London Gazette, October 6, 1937

General Duties Branch

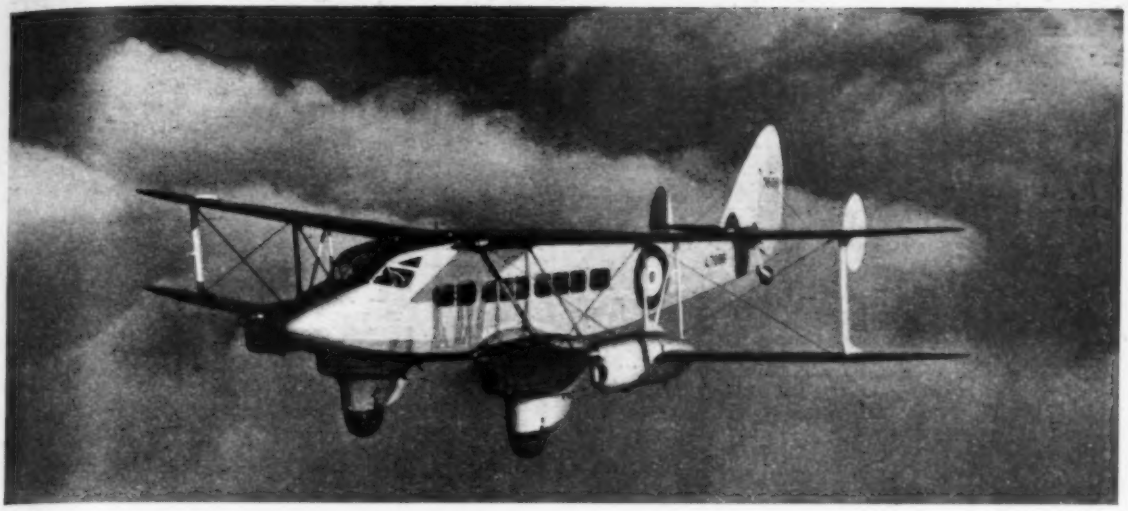
Flt. Lt. D. A. Gibson is granted a permanent commission (July 27).

The following are granted short service commissions as Pilot Officers on probation with effect from and with seniority of September 10:—M. L. McColm, E. H. Thompson, P. S. Weaver.

The following are granted temporary commissions as Flying Officers on attachment to the R.A.F. (September 12):—LIEUT., R.N.—J. G. Lincoln. SUB-LIEUTS., R.N.—R. S. Baker-Falkner, B. E. Boulding, R. H. P. Carver, R. W. V. Hamilton, A. A. Pardoe, H. E. J. Page-T. Parker, E. G. Tyler. ACTING SUB-LIEUT., R.N.—W. A. F. Fryer. LIEUTS., R.M.—E. D. McIver, J. N. Snow.

Pilot Officer on probation C. G. S. Robinson is confirmed in his appointment (August 1); Pilot Officer on probation J. L. Beck is confirmed in his appointment (August 27).

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates



IN SERVICE DRESS : To replace the D.H.89 which members of the Air Council have used for their official journeys since 1935, the De Havilland Company last week delivered this D.H.86B. This well-known commercial type, with its four 200 h.p. Gipsy Six I engines, cruises at 140 m.p.h. (*Flight* photograph.)

stated:—M. L. ff. Beytagh (June 29); M. J. Earle (June 30); D. M. Doran (July 9); L. M. Craigie Halkett (September 4); P. Burnett, M. A. Goodwin, F. V. Morello, S. A. F. Robertson, R. L. C. Todd, H. St. G. Turner, J. L. Waters (September 23).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation with effect from August 17, and confirmed in their appointments with effect from the dates stated:—C. G. Saunders (September 14); R. T. Chisholm (September 16).

Acting Pilot Officer on probation C. T. V. Craxton is graded as P/O. on probation with effect from August 24, and is confirmed in his appointment with effect from September 21; Acting Pilot Officer on probation J. B. Murray is graded as P/O. on probation (August 31).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—R. H. S. McConnell, H. M. T. Neugebauer, D. N. J. P. Leggett (September 3); D. C. Oliver (September 11).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—C. N. Swann (September 14); J. A. Kent, M. M. J. Stevens, T. M. Evans, S. Dodds, J. Riley (September 15); H. A. R. Holford (September 29).

Sqn. Ldr. W. N. Plenderleith is granted the acting rank of Wing Cdr. (unpaid) (September 20); Sqn. Ldr. H. N. Thornton, M.B.E., relinquishes the acting rank of Wing Cdr. (unpaid) (September 1); Wing Cdr. E. L. Howard-Williams, M.C., ceases to be seconded for duty with the Iraqi Government (October 1) Sqn. Ldr. H. E. Forrow, O.B.E., ceases to be seconded for duty with the Iraqi Government (October 1); Flt. Lt. A. C. Weldon (Capt., Royal Irish Fusiliers) ceases to be seconded to the R.A.F. on return to Army duty (September 18); Flt. Lt. C. G. Hill (Capt., Royal Irish Fusiliers) ceases to be seconded to the R.A.F. on return to Army duty (September 18); Flt. Lt. W. E. Hooper is transferred to the Reserve (August 31); Flt. Lt. J. C. Evans is transferred to the Reserve, Class A (September 16); Flt. Lt. D. P. McKeown is transferred to the Reserve, Class C (September 14); Acting P/O. on probation J. R. C. Randle relinquishes his short service commission on account of ill-health (October 1).

Equipment Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant (September 1):—W. Eccles, F. B. C. Fundrey.

Medical Branch

H. V. Thomas, L.R.C.P. and S., is granted a short-service commission as a Flying Officer for three years on the active list with effect from and with seniority of September 20; Flt. Lt. J. M. Ritchie, M.B., Ch.B., is promoted to the rank of Squadron Leader (September 1).

The following Flying Officers are promoted to the rank of Flight Lieutenant with effect from September 7 and with seniority of September 7, 1936:—P. A. Lee, M.B., Ch.B., J. R. Cellars, M.B., Ch.B.

Chaplains Branch

The Rev. C. P. N. Rowband, M.A., relinquishes his short-service commission on completion of service (September 6); the Rev. R. Rees relinquishes his short-service commission (September 29).

Erratum

In the *Gazette* of September 17. Notification regarding William Foulsham. For Pilot Officer read Flying Officer.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

Capt. T. K. Burton is granted a commission as Flight Lieutenant in Class C (September 6); E. W. Seymour-Hosley is granted a commission as Flying Officer in Class C, with effect from September 28, and with seniority of December 14, 1935.

The following are transferred from Class A to Class C on the dates stated:—Flt. Lt. F. Gower-Jones (June 19); F/O. W. F. Parkinson (September 27).

F/O. J. A. H. Sargeaunt is transferred from Class AA(ii) to Class C (September 16); Flt. Lt. G. L. Gandy is transferred from Class C to Class A (January 6); Flt. Lt. R. H. Stocken is transferred from Class C to Class B (August 27); Flt. Lt. G. Brenton-Coward, D.F.C., relinquishes his Reserve commission on completion of service (September 13).

The following Flying Officers relinquish their commissions on completion of service on the date stated and are permitted to retain their rank:—E. K. Wallis (September 10); S. H. H. Swanton (September 11).

The following Acting Pilot Officers on probation relinquish their commissions on appointment to short-service commissions in the R.A.F. (September 10):—M. L. McColm, E. H. Thompson, P. S. Weaver.

AUXILIARY AIR FORCE

General Duties Branch

No. 612 (COUNTY OF ABERDEEN) (A.C.) SQUADRON.—R. B. Thomson is granted a commission as Pilot Officer (September 4).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Marshal.—P. B. Joubert de la Ferté, C.B., C.M.G., D.S.O., to Headquarters, R.A.F., India, New Delhi; on appointment as Air Officer Commanding, 29.9.37.

Group Captains.—L. G. S. Payne, M.C., A.F.C., to Air Armament School, Eastchurch; to command vice Group Capt. R. H. Kershaw, 6.9.37. C. H. Keith, to Special Duty List for duty as R.A.F. Member of Ordnance Committee, Royal Arsenal, 13.9.37.

Wing Commanders.—W. Underhill, D.S.C., to R.A.F. Station, Worthy Down; to command vice Group Capt. C. H. Keith, 13.9.37. Acting Group Capt. R. H. M. S. Saundby, M.C., D.F.C., A.F.C., to Directorate of Intelligence, Air Ministry; for duty as Deputy Director of Operations, 18.9.37. C. N. Lowe, M.C., D.F.C., to R.A.F. College, Cranwell; for duty as Officer in Charge, 20.9.37. J. H. Dand, M.B.E., to R.A.F. Station, North Weald; to command, 6.9.37. J. H. O. Jones, to No. 201 (General Reconnaissance) Squadron, Calshot; to command, 20.9.37.

Squadron Leaders.—Acting Wing Cdr. E. P. M. Davis, A.F.C., A.M., to Special Duty List; on appointment as Air Attache, Brussels, 1.9.37. R. R. Nash, to Inspectorate General, R.A.F.; for duty as Personal Assistant to Inspector General, 1.9.37. J. L. Airey, D.F.C., to Headquarters, No. 4 (Bomber) Group, Linton-upon-Ouse; for Air Staff Duties, 13.9.37.

Flight Lieutenants.—B. H. Becker, B. A. Chacksfield, H. B. Hurley and J. C. Pope, to Home Aircraft Depot, Henlow, 29.8.37. M. Q. Candler, to No. 220 (General Reconnaissance) Squadron, Bircham Newton, 8.9.37. P. C. Lawrence, to No. 44 (Bomber) Squadron, Andover, 24.9.37. H. Eeles, to Air Ministry, for duty as Personal Assistant to the Chief of the Air Staff, 1.9.37. J. N. Knowles, to No. 812 (Torpedo Spotter Reconnaissance) Squadron, 1.10.37. C. H. Johnson, to No. 1 School of Technical Training (Apprentices), Halton, 30.8.37. R. C. Jordan, to R.A.F. Station, Aldergrove, 24.9.37. T. N. Coslett, to No. 54 (Fighter) Squadron, Hornchurch, 30.8.37. J. G. G. Moore, to No. 17 (Fighter) Squadron, Whyteleafe, 15.9.37. V. D. Morshead, to No. 149 (Bomber) Squadron, Mildenhall, 12.9.37.

Flying Officers.—A. F. Bandidt, S. G. Birch, D. O. Finlay, B. Robinson and C. F. Sarsby, to Home Aircraft Depot, Henlow, 29.8.37. C. W. K. Nicholls, to R.A.F. Depot, Middle East, Aboukir, Egypt, 11.9.37.

Pilot Officers.—E. J. Brooks, to No. 228 (General Reconnaissance) Squadron, Pembroke Dock, 17.9.37. A. R. Putt, to Electrical and Wireless School, Cranwell, 30.8.37. P. H. R. R. Terry, to R.A.F. Station, Halton, 16.9.37. K. V. Garside, to No. 10 Flying Training School, Tern Hill, for flying training on appointment to a permanent commission as Pilot Officer, 21.8.37. T. E. J. Fitton, to No. 9 Flying Training School, Hullavington, 16.9.37.

Acting Pilot Officers.—The undermentioned are posted to No. 11 Flying Training School, Wittering, with effect from 18.9.37:—L. S. Campbell, J. K. Collins, R. P. Y. Cross, D. McK. Edmondson, L. E. Ellis, L. H. Eno, L. H. Folkard, A. S. Johnston, C. E. Jones, E. B. Lancaster, L. A. Lynn, J. L. Mayfield, R. M. Milne, D. M. Taylor, E. N. Taylor, W. D. Adams, E. W. Brown, W. R. Farnes, P. R. Burton-Gyles, T. K. G. Dudley, W. H. George, D. A. E. Jones, A. S. Mann, F. A. Morant, G. B. Morgan-Dean, J. A. Pritchard, T. P. Pugh, B. Ruffell, C. A. Rust, S. L. Sigurdson, G. W. Slee, D. H. Wardlaw, R. B. Whittington, and D. W. T. Withers. S. A. Levenson, to No. 8 Flying Training School, Montrose, 30.8.37.

The undermentioned are posted to No. 2 Flying Training School, Brize, Norton, with effect from 18.9.37:—D. G. Baker, D. M. Barker, A. Q. Cairns, L. C. Deane, A. C. Dier, N. H. Elliot, W. H. Flint, E. C. Fyson, D. E. Garland, A. D. Gosman, M. L. Hulton-Harrop, A. J. Oettle, A. M. Ross, I. J. Spencer, A. C. Stewart, W. H. Stratton, M. W. H. Uphill, A. M. L. Alderton, H. C. Bailey, A. L. V. Barnes, J. Browning, W. J. Burnett, G. P. Christie, G. L. Cooper, P. F. McD. Davies, W. C. Duncan, F. B. Gabb, J. Hamlyn, T. M. Horgan, A. C. Roberts, D. S. Robertson, G. Wright, and R. A. Yates-Earl.

Equipment Branch

Squadron Leader.—N. W. Law, to R.A.F. Station, Tern Hill, for Equipment duties vice Sqn. Ldr. S. Bingham, 20.9.37.

Accountant Branch

Flight Lieutenants.—R. T. Carter, to Headquarters, Fighter Command, Stanmore, 27.9.37. W. F. Quilliam, to R.A.F. Station, Abingdon, 20.9.37.

Flying Officer.—S. M. MacIldowie, to R.A.F. Station, Hendon, 15.9.37.

Commissioned Engineer Officers

Flying Officer.—W. R. Mayes, D.S.M., A.F.M., to Headquarters, Fighter Command, Stanmore, 13.9.37.

Medical Branch

Group Captain.—F. N. B. Smartt, to Central Medical Establishment; for duty as President, No. 2 Medical Board, 21.9.37.

Wing Commanders.—B. F. Haythornthwaite, to Headquarters, Coastal Command, Lee-on-the-Solent, 23.9.37; for duty as Deputy Principal Medical Officer (Hygiene), vice Sqn. Cdr. V. S. Ewing. V. S. Ewing, to Princess Mary's R.A.F. Hospital, Halton, 27.9.37.

Flight Lieutenants.—A. W. Callaghan, to R.A.F. Station, Abingdon, 20.9.37. J. S. Carslaw, to Medical Training Depot, Halton, 21.9.37. H. D. Conway, to R.A.F. Station, Upwood, 22.9.37. H. L. Willcox, to R.A.F. Station, Calshot, 21.9.37. C. A. Rumball, to R.A.F. Hospital, Cranwell, 25.9.37. C. M. Carlyle-Gall, to R.A.F. Station, Aldergrove, 25.9.37. F. H. Peterson, to Air Armament School, Eastchurch, 27.9.37. A. W. Smith, to No. 1 Flying Training School, Leuchars, 27.9.37.

Flying Officers.—H. V. Thomas, to Medical Training Depot, Halton, 27.9.37. R. M. Hewat, to Special Duty List, on appointment to a short service commission (whilst holding a House Appointment at St. Mary's Hospital), 14.8.37.

Dental Branch

Flight Lieutenant.—D. I. Malcomson, to R.A.F. Depot, Henlow, 24.9.37.

Chaplains Branch

Rev. F. E. H. Trevor, to No. 1 R.A.F. Depot, Uxbridge, for duty as Chaplain (C. of E.) on appointment to a short service commission.

A "ZEPP-STRAFER"

THE interesting appointment of Inspector of the Iraq Air Force has been held during the last few years by the popular writer, Wing Commander Howard-Williams. He is now to be succeeded by another officer whose name will live in Air Force history, Wing Commander S. D. Culley, D.S.O. In the summer of 1918 the operations of the Harwich Light Cruiser Force were constantly hampered by patrolling Zeppelins. The airships kept at a height of some 20,000 feet, and were out of the reach of the anti-aircraft guns on the ships, while the flying boats from Great Yarmouth and Felixstowe also could not climb to within range of them. Only one of the latest landplane fighters could reach them, and they had not the range to fly out from the shore. But if a Camel could be towed out to the region where the airships were wont to operate, then there was a chance of success. It was decided to make the attempt.

Lieut. Culley, of the old R.N.A.S., had had much practice in deck flying, and had also once taken off from a towed lighter, so he was chosen for the task. On the evening of August 10 the Harwich Force put to sea, the destroyer *Redoubt* towing the lighter on which Culley's Camel was made fast. Three flying boats from Yarmouth flew out next morning to act with the flotilla. Major (now Air Commodore) Robert Leckie, who had with Major Egbert Cadbury already shot down the Zeppelin L70 with Capt. Peter Strasser, head of the Naval Airship Service, on board, was in one of the boats and got a message from a coastal motor boat that a Zeppelin was about. He caught sight of it, and knowing that he could not reach it himself, he flew over the flotilla, and by visual signal reported its position.

The *Redoubt* went full steam into the wind, and Culley's Camel took off after running only five yards along the platform on the lighter. Culley climbed for an hour to 18,800 feet, where the Camel had reached its ceiling. The L53 (Capt. Proelss) was about 200 feet above him. Flying out of the sun, Culley approached the L53 which was flying towards him. He opened fire with two Lewis guns. One jammed, but the other set the airship on fire. This was at 9.58 a.m., about ten miles S.W. of Borkum Riff lightship.

It is stated in *The Story of a North Sea Air Station*, by C. F. Snowden Gamble, that Culley "saw one of the crew jump from her (a distance of nearly three and a half miles), his clothes alight, but extraordinary as it may seem, this man was picked up later, practically uninjured, by a Dutch fishing vessel." Culley found his lighter and was picked up with his petrol nearly exhausted.

Death of Lieut. Col. Spenser Grey

IT is with extreme regret that *Flight* records the death of Lieut. Col. Spenser Grey last Friday as a result of a fall from the roof of his flat in London while rigging up an aerial for his wireless.

Spenser Douglas Adair Grey, D.S.O., was one of the early British pilots. Born on February 10, 1889, he began his career in the Royal Navy, but soon developed a liking for flying, and in its issue of August 26, 1911, *Flight* recorded the following achievement: "Although he had only had seven lessons at the Hewlett-Blondeau School at Brooklands, Lieut. Spenser Adair Grey, on Monday week, made the necessary tests for his *brevet* in masterly style, his confident handling of the machine speaking well for his future as a pilot."

After getting his ticket Spenser Grey did a great deal of flying, first on Blackburn monoplanes and later on Shorts. During the war he had a distinguished career in the R.N.A.S. and was awarded his D.S.O. for bombing the military railway station at Cologne from 600ft. in October, 1914. As a result of injuries in some bad crashes Spenser Grey was retired from actual flying and lent as liaison officer to the American air force in Paris. After the Armistice he was invalided out of the service with the rank of Lieutenant-Colonel, R.A.F. So far as we remember, Spenser Grey only appeared once after the war in the role of pilot. That was in an air race in which he piloted a Blackburn Kangaroo, which had been entered by Mr. Winston Churchill. With the death of Spenser Grey has disappeared one more link with the heroic days of flying. To his wife the whole British aviation community, and particularly that part of it which dates back to the early days, extends its heartfelt sympathy.

Wolseley Engine Amalgamation

A STATEMENT issued by Lord Nuffield says that the liquidation of Nuffield Mechanisations, Ltd., is being carried through for the purpose of the amalgamation of the business of that company with Wolseley Aero Engines, Ltd. The name of the latter has consequently been changed to Nuffield Mechanisations and Aero, Ltd. Neither the company in liquidation nor the newly named concern is a subsidiary company of Morris Motors, Ltd.

In connection with this reorganisation, it may be remembered that early this year it was announced that the Wolseley engine rights would be acquired by Scottish Aircraft, Ltd., and that the engine would be known as the "Clyde." Negotiations, however, fell through, and the deal was not completed.

THE SWING of the PENDULUM

Tricycle Experiments: The two upper views show a new Monospar machine adapted for tests. A more unorthodox version is the Avro Avian (below) fitted with the Cowey-Eugster undercarriage, in which the main wheels are far forward and the rear wheel almost under the pilot.

Return of the Tricycle Undercarriage : Extra Drag Makes Retraction Essential

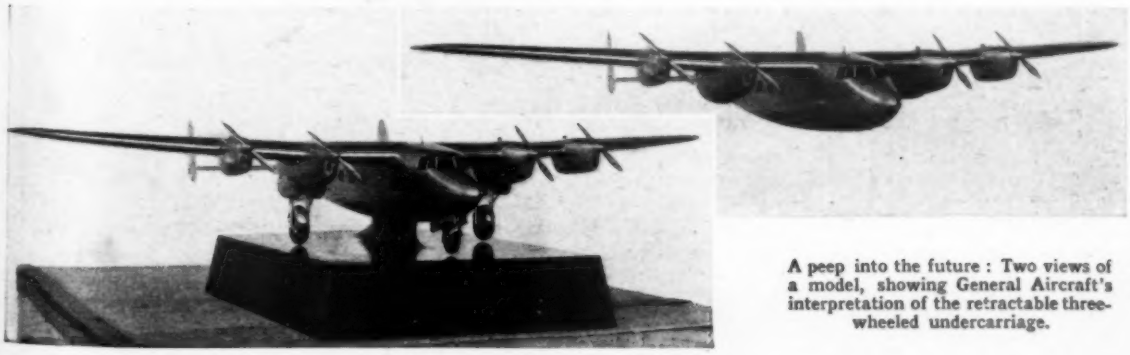
DESIGNERS all over the world are hard at work on producing undercarriages with more than the two wheels which have become the standard equipment of aeroplanes. The schemes being evolved differ greatly in their details, but all depend upon the same fundamental principles; or, rather, all except one.

To appreciate the reason for this revival in multi-wheel undercarriages it is necessary to remember that the lift curve of an aeroplane wing is very nearly a straight line from the angle of no-lift to the angle of maximum lift, and that when the angle of maximum lift is exceeded there is a falling-off in lift, the curve dropping again, suddenly with some wing sections and more gradually with others.

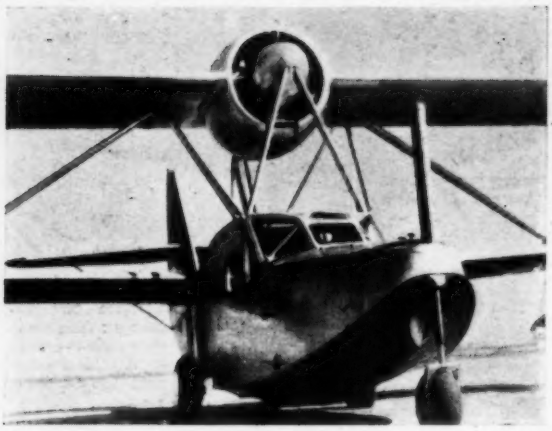
When an aeroplane is coming in to land, it is the endeavour of the pilot to bring it in as near to the angle of maximum lift as possible, so that his landing run after touching down may be as short as possible. The flight path has to be very accurately judged so that the attitude and speed of the machine, and its height above the ground are such that at the moment when the speed drops to stalling speed, the "dropping of the tail," which is merely the pilot's deliberate action of increasing the angle of incidence of the wings to beyond stalling angle, causes a loss of lift, increase in drag, and the gentle sinking of the machine on to the ground.

It is, of course, quite obvious that if one of the three main factors involved is not exactly "right," an imperfect landing will result. For example, if the pilot drops the tail while still some ten or twelve feet above the ground, the machine will pancake down and make a heavy landing; possibly something will be strained or even broken. If the height is correct but the speed too great, the machine will "balloon off" when the tail is dropped, and it may be necessary to open the throttle and make another attempt. Even if this does not become necessary, and lift is reduced by raising the tail again, the machine will take a longer landing run than intended.

Admitting that the orthodox two-wheeled undercarriage has been responsible for most of the difficulties associated with landing an aeroplane, the surprising thing is, not that there should be a marked tendency towards a return to the type of



A peep into the future: Two views of a model, showing General Aircraft's interpretation of the retractable three-wheeled undercarriage.



Designed in 1933 : The Curtiss-Courtney amphibian had a retractable nose wheel as well as retractable main wheels. In addition to being almost buried while in flight, the nose wheel of the amphibian formed a useful fender when coming up to moorings.

undercarriage which was familiar in the earliest days of flying, but that the two-wheeler should have persisted for so long.

What has caused the two-wheeled undercarriage to be the source of these landing difficulties is the fact that the wheels must be placed ahead of the centre of gravity of the machine; otherwise there would be a marked tendency to nose over on making contact with the ground. The " three-point " landing which is the ambition of every beginner can be traced to the division of the weight of the machine, when on the ground, between the two main wheels and the tail wheel. With the tail wheel on the ground, most aeroplanes will remain in that attitude even if the wheel brakes are applied at fairly high speed, and unless the brakes are put on fairly brutally, there is no risk of nosing-over, thanks to the forward position of the wheels.

The modern multi-wheel undercarriage reverses the process. The two main wheels are placed behind the centre of gravity, and the third wheel is situated under the nose of the fuselage. Thus when the wheels touch, there is a tipping action which raises the tail and brings the front wheel into contact with the ground. This raising of the tail brings the wings to a smaller angle of incidence, thereby reducing their lift and preventing the machine from becoming air borne again. Moreover, the wheel brakes can be applied quite hard, the nose wheel preventing the machine from turning over.

Ancient History

All this was realised by designers in the early days of flying, and nearly all the early aeroplanes had either skids or wheels for preventing nosing-over. Sometimes skids and front wheels were combined in one undercarriage. What led to abandoning the wheel-cum-skid undercarriage was the high drag usually associated with undercarriages of this type, and it was not very long before the simple two-wheeled undercarriage, with two vee struts and a cross-axle, became almost universal.

Now that retractable undercarriages have come into general use, both at home and abroad, it is but natural that an effort should be made to combine the desirable qualities of the tricycle arrangement with the retractable feature, and it is along these lines that the majority of designers are working.

Mention was made above to one exception from the general scheme of two-wheels-behind-the-c.g.-one-wheel-in-front. This is the undercarriage produced in 1936 by British Landing Gears, Ltd., and tested experimentally on an old Avro Avian at Hanworth (see *Flight* of June 18, 1936). In the Cowey-Eugster undercarriage the main wheels are farther ahead of the c.g. than in the orthodox undercarriage, and the third wheel is under the fuselage, aft of the pilot's seat. The rear wheel is well sprung, and prevents the machine from " ballooning " even in a hard landing at fairly high speed. It is understood that developments are proceeding and that an undercarriage of the Cowey-Eugster type, made retractable, is to be tested on a military aircraft shortly.

Recently General Aircraft, Ltd., of Hanworth, have been making flying tests with a tricycle undercarriage fitted to one of their Monospar machines. The arrangement is shown in the photographs and it will be obvious that it is intended for experimental tests only, as it is not retractable. Such features as the placing of the wheels in relation to the centre of gravity can, however, be tried out. It will be obvious that many things have to be taken into consideration. For example, if the main wheels are too far aft of the c.g., the speed which has to be attained before the elevator control is powerful enough to depress the tail will be needlessly great. On the other hand, if the distance is too short, a tail-down landing would tip the nose up, and the main object of the arrangement would be defeated. It is interesting to learn that General Aircraft have come to the conclusion that the tricycle undercarriage is so well worth while that they even regard the abandonment of the present fashionable low-wing monoplane as warranted, and a reversion to the high-wing arrangement. The latter has other advantages, including a better view for the passengers, and General Aircraft's idea of how such a machine might appear is illustrated in the two views of a model of a four-engined high-wing monoplane. It will be observed that with this arrangement the height of the cabin floor above the ground is quite moderate, and passengers will certainly appreciate the level floor.

Anglo-U.S. Experiment

One of the first, if not actually the first, to realise the advantages of the retractable tricycle landing gear was an Englishman, Captain Frank Courtney, who, in 1933, began the design of an amphibian pusher flying boat for the Curtiss-Wright company. The main wheels retracted into the sides of the hull, and the front wheel could be withdrawn into a cavity in the nose of the hull. The fact that the nose had to be watertight made the task more difficult, but Capt. Courtney solved the difficulty in the manner shown in two of our pictures. The strut of the front wheel telescoped into a streamline fairing above the nose. This post was used as a hand hold when mooring the machine. With the front wheel retracted, the tyre projected slightly and formed a very useful bumper or fender.

Capt. Courtney, who has now returned to England, points out that a not-very-obvious but highly important advantage of the tricycle landing gear, from the operators' point of view, is the time saved in taxying. Due to the possibility of applying the brakes hard without fear of nosing-over, the machine can be taxied at high speed to the other side of the aerodrome when wind direction makes this necessary.

Right but not retractable . The Coanda Bristol monoplane of 1912 had its main wheels behind the c.g., and front wheels to prevent nosing-over.

COMMERCIAL AVIATION

ON HER WAY: Trials of the De Havilland Albatross high-speed, long-range transport are still proceeding at Hatfield and this most beautiful of all large aeroplanes is frequently seen over Hertfordshire slipping along comfortably at her 210 m.p.h. cruising speed. This, her latest picture, was obtained during trials by Major Hereward de Havilland. (*Flight* photograph.)

THE WEEK AT CROYDON

Travel in Troublesome Times : Competition Among the Beacons : Sir Graham Mackinnon : Tying-in the Passenger

THE keynote of the week's air traffic on the scheduled lines was its uneventfulness. Passenger traffic steadily increases each winter, and just at the moment a lot of freight is being carried. The passenger increase is the more remarkable when you think of the disturbed state of Europe. There are people who cannot, will not or dare not visit certain countries, and nobody can be particularly tempted by travel abroad just at the moment. I myself would sooner go bathing amongst the basking sharks off the coast of North Scotland than amongst the basking submarines and subsequent depth charges in the Mediterranean.

In these days the old neon beacon is a bit of a back number, no doubt, and not much used except as one of many other and more scientific ways of getting down in hazy weather. It throws, of course, a shapeless pink glow in fog, and it is somewhat disconcerting to find that a neighbouring factory, on a totally different edge of the landing ground, has erected a huge neon sign which seems likely to throw an almost identical, but possibly more powerful, red glow. The factory people have done this in all innocence, of course, but it is rather like duplicating a shipping light for advertising purposes. It is comparatively immaterial that the beacon flashes and the sky sign does not, for a pilot looking out for a red glow may have it in sight for only a split second.

It was with considerable surprise that the student of aeronautical affairs read last week of the resignation of Sir Percy Graham Mackinnon from the Board of Directors of British Airways, Ltd. Sir Percy has been a member of Lloyds for over forty years and has been chairman of Lloyds five times, no less. We have not seen him at Croydon very much of late but in the days of British Continental Airways he was a frequent and welcome visitor. British Continental Airways rose to a very high level of efficiency in a remarkably short time under Sir Percy's able leadership, for besides a keen interest in aviation which led him to fly all over Europe, and beyond, he brought balanced judgment and shrewd business experience to bear on its problems. Later, as everyone knows, amalgamation took place between British Airways and British Continental Airways.

What one is almost tempted to regard as material for a high-speed "Forsyte (or Forsyth) Saga" was contained in a remarkable business flight made by Mr. E. G. H. Forsyth, accompanied by Mr. Norman Samuels, of Surrey Flying Services. The machine used was Mr. Forsyth's Miles Falcon, and despite winter conditions comfortable travel without untoward incidents was experienced. The places called at were Paris, Lausanne, Milan, Venice, Sukar and Belgrade on the outward trip, and the return trip was via Zagreb, Venice, Milan, Marseilles, Paris and Le Touquet back to Croydon, where Mr. Forsyth's Falcon is stabled with S.F.S.

What are variously referred to as body belts, lap straps, waist reducers of safety belts have now become compulsory

on all British aeroplanes for passengers. These belts have been fitted to the machines of certain firms, notably K.L.M. and Swissair, for as long as I can remember, though they are usually tucked away out of sight. In Europe it has never been the practice to insist on passengers using them for take-off or landing, nor is this normally necessary. They have come in useful, however, when outrageous weather prevented the possibility of avoiding that storm-tossed feeling, and also they have been used on the rare occasions when a tyre has become deflated and a roughish landing was to be expected. My own experience is that in the past they were never to be found where most wanted, viz., in small machines used on internal routes where a number of fairly close-set landing places did not allow of flying high enough to avoid bumps. Item: you cannot read a newspaper when you need both hands to hold yourself down in your seat.

Commander Ivan Smirnoff, of K.L.M., made a notable flight from the East after the company's accident. Leaving Batavia a day late he got to Rangoon in two days and then did what is normally two days' flying in a single day—Rangoon to Baghdad, a distance of 3,616 miles. Consequently the aeroplane arrived to schedule in Amsterdam on Monday, October 11, and, moreover, the passengers for England were able to catch the 5 p.m. machine, arriving Croydon 6.25 p.m. It is noteworthy that this was no record-breaking attempt but merely making up of lost time in order to arrive on schedule.

On Monday, too, D.L.H. conveyed Herr von Ribbentrop to Cologne by special machine in the fairly early morning. The machine then returned to Croydon to pick up Herr W. E. Bohle, who was also flown to Cologne. The same day H.E. the Netherlands Minister in London arrived by Scandinavian Air Express.

International Air Freight, Ltd., it is understood, are having alterations made to their freighters to accommodate motor cars up to the 10 h.p. class.

A. VIATOR.

Azores Survey

ALTHOUGH the season's North Atlantic survey flights have been completed, the winter period is obviously the time during which a survey of the southerly route should be carried out. This is the one which, it is expected, will be used when the North Atlantic route is difficult or impossible.

Caledonia, commanded this time by Capt. G. J. Powell, left Southampton at 8.14 a.m. on October 6 and reached Lisbon, non-stop, at 2.10 p.m. She left for the Azores on October 7 and started her return flight again on October 11. The flight has been organised in order to test the ground services in Portugal and the Azores and to collect general data about this section of the route, which has already been experimentally covered on a number of flights by D.L.H. It will be remembered that *Cambria* also visited Lisbon.

A Personal Matter

UNLESS a charter firm lives solely on photographic or other Press work, it is necessary for this firm to concentrate very much on the business of making its clients extremely comfortable and making them feel that, *pro tem.*, the machine is their own property and the pilot at their entire disposal.

Looking at Personal Airways' more recent acquisition, a specially equipped Rapide, it is possible to see what can be done on these lines. In this machine, which has been furnished by Rumbolds, there is every appearance of spacious comfort. Normally there are only four super-chairs and the rest of the available space is for the use of the passengers' legs and the stowage of very excess luggage. The radio transmitter (which is behind the bulkhead) is arranged in a cabinet which makes it look like anything *but* a transmitter, and the receiver has a switch-over system so that, when not in use on the aeronautical waveband, the passengers may listen to broadcasts. When no radio operator is carried, Capt. Ledlie or one of the other regular Personal pilots, E. D. Crundall and R. G. Ashley, has a tapping key permanently arranged in the cockpit so that, even then, W/T can be used on Continental trips.

Personals now have the use of four Rapides, a Leopard and a Miles Falcon, the single-engined machines being used almost entirely for Press work (where life and limb are of insignificant importance). The company has a complete hangar to itself and is doing its own maintenance.

Cornish Terminal

THE first official notification of the fact that the Scilly Islands service is now in operation appears in the form of a *Notice to Airmen* (No. 216) giving the position and dimensions of a Land's End aerodrome. This lies 1¼ miles to the south of St. Just and is controlled by Channel Air Ferries.

Apart from its value to the operating company concerned, this new aerodrome should be an attractive addition to those which can be used by private owners who have not previously looked on Cornwall as a prospective visiting centre.

This B.A.L.P.A.

ONE way or another the British Air Line Pilots' Association, which had previously worked and grown up rather out of sight of the ordinary run of mankind, is now appearing in the limelight—a state of affairs which does not please the members very greatly, but which was quite inevitable in the circumstances.

For the benefit of those to whom B.A.L.P.A. is merely a name, it might be as well to give an outline of the Association's real objects. In fact, it may be described as a parallel organisation to the older American A.L.P.A., of which, it appears, any pilot who expects to obtain a job must be a member. Far from being what a friend of ours described as a Bar-Grousing Association, B.A.L.P.A. not only has certain clearly defined and generally admirable plans for the future, but also possesses a large and representative membership. Actually there are approximately 200 members drawn from seven companies, so the power should be there. Nor is the membership confined to lesser lights—familiar names crop up throughout the list.

Briefly, the objects of the Association are as follows: To maintain the status of the transport pilot's profession and to protect individual members from any possibility of unfair treatment; to ensure that such pilots have some say in the choice and equipment of the machines which they are expected to fly; to correlate the opinions of pilots on such matters as flying pay and to see that an equitable arrangement is reached; and to operate its own pensions scheme.

There appears to be nothing "subversive" (whatever that word may mean) about either the Association or its objects.

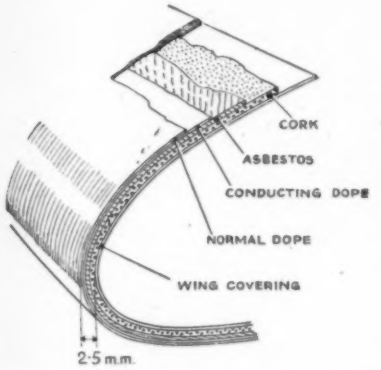
FREIGHT ONLY: One of International Air Freight's Curtiss Condors on the tarmac at Croydon. These machines have been specially modified to take really large pieces of freight and to simplify the loading process. (*Flight* photograph)

THERMAL ICE PREVENTION

Attacking the Problem from a New Angle : An Interesting French Development : Research Facts and Figures

THE normally interested person may be forgiven, perhaps, for wondering vaguely why the problems of the prevention and removal of ice formations on aircraft have not been tackled thermally. Success in this field has been achieved both by the Dunlop anticer—originally developed at Farnborough—and by the Goodrich de-icer. The former is a chemical preventive measure, a Glycol film oozing through a porous covering, combating adhesion, and the latter is a mechanical "cure," the ice being detached by the inflation of rubber overshoes covering the leading edges. Chemical substances, notably Killfrost, may also be applied to the affected parts before each flight.

Electrically produced heat is used for the prevention of formations on such minor but important items as pitot heads, and, more recently, radio antennae. No one, however—with the exception of D.L.H., who, we believe, carried out a series of experiments with exhaust heating—appeared to have paid very serious attention to the possibility of using heat as a means of de-icing or anticing the comparatively large surfaces involved.



A diagrammatical section through the heated covering suggested by Messrs. Rideau and Ducret.

The reason for this neglect has been a simple one. A few minor calculations have shown that the amount of heat—and, consequently, of power—necessary to keep the wings at a suitable temperature would be entirely uneconomical.

Messrs. Rideau and Ducret, of Paris, have tackled this difficulty by insulating the specially heated parts from the bulk of the structure, and Prof. Edmond Brun (*Revue Aeronautique Internationale*, June 24, 1937) has gone far to prove that the degree of heat necessary over these smaller areas need not be uneconomically excessive for successful ice prevention.

The method of isolation used is a simple and inexpensive one, involving the application of a layer not more than 3 mm. thick to the leading edge or other critical points. This covering consists first (that is, next to the metal skin or other wing covering) of a layer of cork, which acts both as an electrical and thermal insulator, then of a thin asbestos sheet sprayed with a colloidal conducting dope, and, finally, of the normal dope. The weight of this covering is about 1 kilogram for every sq. metre.

According to calculations made by Prof. Brun, about 30 h.p. is necessary to heat 10 sq. metres (the area covered by de-icing equipment on medium-large transport machines) through 3 degrees. Needless to say, the maintenance of a temperature, say of 10 degrees above that prevailing outside would necessitate a prohibitive consumption of power, and Prof. Brun has tried to show that there should be no necessity to increase the heat by more than 3 or 4 degrees in order to obtain the necessary results.

Anticer and De-icer

Briefly, his claim is that throughout the really dangerous temperature zone (a matter of 2 or 3 degrees) the Rideau-Ducret system would act as an effective anticer, and in all other circumstances, including those in which the heating system has only been brought into action after the formation has occurred, it would, given a little time, act as an effective de-icer.

This claim is not merely the result of logical conjecture. Numerous wind-tunnel and other tests have been made. It has been shown, for instance, that the different parts of the wing are all warmer than the air around them and that the heating increases proportionately as the square of the speed. In level flight the upper portion of the leading edge is either iced first or is more thickly covered, and the colloidal dope, which is simply sprayed on to the asbestos, can be arranged in different thicknesses according to the degree of heat required over different areas. A series of tests were made to discover the amount of power necessary and the time taken to de-ice certain areas and the results suggest that, in cases where ice has already formed, its removal with a certain maximum degree of power available would be more quickly done if the heating were carried out section by section, the entire power being applied to each section in turn.

Whether or not the system will be practical in service it is not possible to say, but no series of experiments which show promise of success should be neglected. Presumably, flight tests of the Rideau-Ducret system will be made in the near future.

Air Transport Economics

"*Economics of Air Transport*," by S. J. Noel-Brown. Pitmans, 6s.

FROM time to time several aircraft manufacturing companies have produced pamphlets in which operating costs were worked out in considerable detail. These have been interesting, but, however honest may have been the efforts of the writers concerned, one always felt that the figures *might* have been "cooked." So far as we know, *Economics of Air Transport* is the first published work dealing thoroughly with the subject, and is another one of the Air Transport Series now being brought out by Pitmans.

From the operator's point of view the most interesting chapters are undoubtedly those in which commercial efficiency is assessed and specimen operating costs given. Fairly enough, Mr. Noel-Brown has admitted that it is not really possible to assess efficiency by means of a single factor, and that different circumstances demand different factors—largely, of course, because the basic comparative values must vary according to the particular uses for which a machine is required. He has, however, gone very thoroughly into the subject and gives a number of interesting comparisons. As an all-round factor Mr. Noel-Brown recommends one in which the disposable load is multiplied by the cruising speed and divided by the b.h.p. required to fly at this speed. With this the Douglas D.C.3 heads a list of thirteen representative transports. In fact, the two Douglas types and the Monospar Croydon come out extremely well in all the factors used—which suggests that these latter were developed for use with long-distance operations.

The tables of specimen operating costs are interesting more for their value in making comparisons, since estimated costs, however thoroughly and conscientiously given, rarely tally with those actually experienced. However, the *comparative* figures obtained must necessarily be fair, and the specimens are there, in black and white, for any operator's criticisms. In this connection the table showing the effect of the demand for speed on the capital costs of a fleet is illuminating, to say the least of it. Speed certainly seems to cost quite a lot of money.

A New Year Executive

THERE appears to be a very reasonable chance that an example of the American Spartan Executive will be seen in this country early next year. Surrey Flying Services are the agents for this machine, which is something of a last word in high-speed private-owner or charter types. It may be remembered that it is an all-metal five-place monoplane with a cruising speed (at 9,600 feet) of 210 m.p.h. and a standard range of 950 miles. The flapped landing speed is given as 57 m.p.h.

Incidentally, Surrey's continue to turn out their plug tester, and numerous examples have been and are being supplied to Imperial Airways. There is nothing extraordinary or "patent" about this device, which simply permits the visual examination of the sparks of one to four plugs working in a pressure equal to, or a good deal higher than, that under which they are normally working.

Commercial Aviation

MEDIUM WAVE : The new version of the Marconi radio beacon at Croydon, which emits four narrow constant-note beams with alternate dot and dash sectors between.

Irish Airport

CORK is to build an airport at a cost of about £33,000, of which the Government will bear half. Possible situations have been under examination for some time and a site at Midleton, about thirteen miles from the city, has been unanimously selected as the most suitable one. The Department concerned is anxious that the work should be started as soon as possible, and the Cork County Council, the Cork City Corporation and the Cork Harbour Board are collaborating in the necessary investigations. It is hoped that Cork will be linked up both with the Dublin-London service, and with the new transatlantic base at Foynes, Co. Limerick.

Meanwhile, the I.F.S. Government is, by way of educating the public, to arrange for "flying weeks" all over the country. These are to be organised on entirely practical lines, the object being not to provide entertainment but to convince the ordinary business man of the usefulness of air transport. The Dublin-London air route service operated by Aer Lingus Teoranta and Olley Air Service, is fast gaining in popularity. Some three thousand passengers have already been carried during the first year.

New Mediterranean Boat

THERE are excellent reports of the first two trial flights made at the Etang de Berre, Marseilles, by the new Lioré et Olivier flying boat designed and built for the Marseilles-Algiers and Marseilles-Tunis services. Known as the 24-6, this prototype has been completed by the south-eastern group of the Société Nationale des Construction Aeriennes. It is fitted with four Hispano-Suiza 12 Xi engines of 690 h.p. each. The top speed is 210 m.p.h. and twenty-six passengers will be carried on the services.

Jury-rigged

QUEER things can happen in a large machine which is fully equipped with jury-rigged test devices and experimental instrument arrangements.

Last week Major Hereward de Havilland and Geoffrey D.H., Jun., were up in the Albatross on a long-period test flight at 15,000 ft. Whatever the conditions may have been like outside they were flying blind, with ice covering the transparent areas. It was very boring. Suddenly the A.S.I. needle started to jerk back to zero. That was the last straw; Major Hereward prepared to start the descent but first took a look round the cabin.

Geoffrey was sitting on the rubber pressure-tube.

Going Marine

"Seaplanes — Manœuvring, Maintaining, Operating," by Daniel J. Brimm. Pitmans, 10s. 6d.

NOT the least attractive part of this book, which is written by an American pilot of considerable seaplane experience, is the fact that it is couched in a style which is not only readable but, occasionally, almost light-hearted. Seaplane flying, one is made to feel, is an extremely interesting business. The illustrations and their captions are as serious as they are copious, but the light-heartedness crops up at least once. Immediately beneath a serious diagram showing the forces which are acting on a floatplane while it is being turned into wind there is another diagram showing "the embarrassing result of turning into wind too abruptly." They are very embarrassing.

The author appears to have covered the whole technique of seaplane work from bases and their equipment, design considerations, and maintenance, to the handling of such machines both in the air and (so much more important and difficult for the landsman) on the water.

For various reasons, mainly financial, the privately owned or club-owned seaplane has not appeared in this country, but those who feel that everything about normal flying has been learnt might look into this book and find that there is a new and unexplored field of endeavour. Seaplanes, it appears, are neither as tricky nor as useless as the majority of people imagine—so long as the pilot thoroughly understands his two elements. In America, as an article in *Flight* a few months ago suggested, the floatplane is quite popular.

Forthcoming Events

October 20. R.Ae.S. Weybridge Branch Lecture: "The Meaning of Education," by W. H. Wakinshaw, M.A., Vickers Senior Staff Canteen, 6.15 p.m.
October 21. R.Ae.S. Lecture*: "Practical Airscrew Performance," by Mr. F. M. Thomas.
October 26. R.Ae.S. Students' Section Lecture: "Detail Design" by Mr. E. Voss. R.Ae.S. Library, 7 p.m.
November 2. R.Ae.S. Students' Section Lecture: "Light Alloy Castings and Stampings" by Mr. W. C. Devereux. R.Ae.S. Library, 7 p.m.
November 3. R.Ae.S. Weybridge Branch Lecture by Flt. Lt. J. W. Summers. Vickers Senior Staff Canteen, 6.15 p.m.
November 4. R.Ae.S. Lecture*: 'Problems of High-Speed Flight as Affected by Compressibility," by Mr. C. N. H. Lock.
November 5. R.Ae.S. Students' Section: Informal Supper.
November 12. Norfolk and Norwich Aero Club: Annual Ball.
November 16. Institute of Transport: Brancker Memorial Lecture: "Civil Aviation as a World Force," by Lord Sempill. Institution of Electrical Engineers, 6 p.m.
November 17. R.Ae.S. Weybridge Branch Lecture: "Light Alloy Castings and Stampings for Aeronautical Purposes." by W. C. Devereux, Vickers Senior Staff Canteen, 6.15 p.m.
November 18. R.Ae.S. Lecture*; "The Take-off Problem," by Mr. H. F. Vessey.
November 25. C.A.S.C.: Dance, First Avenue Restaurant, London, W.C.1.
December 1. R.Ae.S. Weybridge Branch Lecture: "Large Aeroplanes," by Dr. H. Roxbee-Cox. Vickers Senior Staff Canteen, 6.15 p.m.
December 2. R.Ae.S. Lecture*: "Wing Surface Controls with Reference to Possible Developments in Flying Technique," by Ft. Lt. H. P. Fraser.
December 8. Colleges of Automobile and Aeronautical Engineering: Annual Dinner and Dance, Grosvenor House, London.
December 8. R.U.S.I. Lecture: "Balloon Aprons," by Air Comdre. J. G. Hearson, Royal United Service Institution, 3 p.m.
December 10. Strathtay Aero Club: Annual Ball, Salutation Hotel, Perth.
December 15. R.Ae.S. Weybridge Branch Lecture: "Anodic Treatment," by J. Donaldson Craig. Vickers Senior Staff Canteen, 6.15 p.m.
December 16. R.Ae.S. Lecture*: "Development of Sailplanes," by Sqn. Ldr. G. M. Buxton.
December 17. London Aeroplane Club: Dinner and Dance, Park Lane Hotel, London.

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January 5. R.U.S.I. Lecture: "The Training of a Royal Air Force Pilot," by Air Vice-Marshal L. A. Pattinson. Royal United Service Institution, 3 p.m.
January 13. R.Ae.S. Lecture*: "Radio as a Direct Aid to Landing Approach," by Sqn. Ldr. R. S. Blucke.
January 26. R.U.S.I. Lecture: "Imperial Air Routes," by Lieut.-Col. H. Burchall, Royal United Service Institution, 3 p.m.

* All these lectures take place at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, beginning at 6.30 p.m.